

STATE OF CALIFORNIA DEPARTMENT OF PUBLIC WORKS

PUBLICATIONS OF THE DIVISION OF WATER RESOURCES EDWARD HYATT, State Engineer

BULLETIN No. 43 SOUTH COASTAL BASIN INVESTIGATION

VALUE AND COST OF WATER FOR IRRIGATION

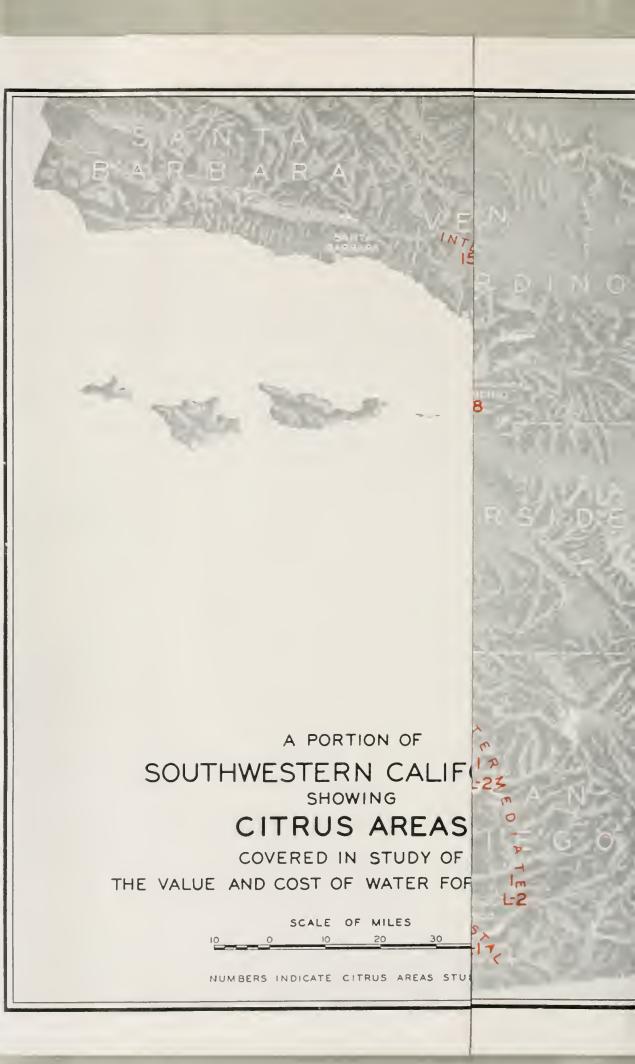
IN

COASTAL PLAIN OF SOUTHERN CALIFORNIA

Prepared under cooperative agreement between the College of Agriculture, University of California, and the Division of Water Resources, State Department of Public Works.

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LETTER OF TRANSMITTAL

Mr. Edward Hyatt, State Engineer, Sacramento, California.

Dear Sir:

There is transmitted herewith a report entitled "The Value and Cost of Water for Irrigation in the Coastal Plain of Southern California," by Frank Adams and Martin R. Huberty of the Division of Irrigation Investigations and Praetice of the University of California.

This report has been prepared with the financial assistance and the close cooperation of the Division of Water Resources, and is therefore available for publication by you as a cooperative report, if you so desire.

In transmitting this report, it is desired to recall that the questions which enter into the value of water for irrigation are exceedingly complicated. They involve not only some of the fundamental principles of economies, but also the practical application of those principles to

varied physical and economic situations in the field.

Because of the limited time available for the investigation leading up to this report, the authors have chosen to confine themselves very largely to the assembling of data, to acquiring an intimate understanding of the physical situations in the southern coastal plain as they are related to its agriculture, and to the presentation of the information assembled in such manner as to make it most useful to those concerned with particular problems in which the value and cost of water are factors. It has seemed best to the authors to discuss the principles involved only to the extent necessary to make clear their procedure.

Very sincerely yours.

Dean. College of Agriculture.

Berkeley, California June 1, 1933.

ACKNOWLEDGMENT

In the preparation of this report the authors have had the very helpful counsel of the following advisory committee appointed by Dean Hutchison: Dr. L. D. Batchelor, Director of the Branch of the College of Agriculture in Southern California; R. L. Adams, Professor of Farm Management; M. R. Benedict, Professor of Agricultural Economics; Professor L. B. Smith, Assistant State Leader, Agricultural Extension Service; Warren R. Schoonover, Extension Specialist in Citriculture; and L. W. Fluharty, Specialist in Agricultural Extension. liminary draft of the report was submitted by the writers to a group of growers and others interested at Los Angeles on April 28, 1933, and many valuable suggestions were obtained from them. This preliminary draft has also been read, and helpful suggestions for improvement submitted by Professor R. W. Hodgson, Assistant Director, and S. H. Beckett, Professor of Irrigation Investigations and Practice, in the Branch of the College of Agriculture in Southern California, and by David Weeks, Associate Professor of Agricultural Economics, Berkeley. The Irrigation Division of the Bureau of Agricultural Engineering, United States Department of Agriculture, furnished field headquarters at Pomona for the investigation, and Paul A. Ewing, Wells A. Hutchins, Harry F. Blaney, and Colin A. Taylor of that division read the preliminary draft and gave helpful suggestions Acknowledgment of assistance by others is made in regarding it. the text.

ORGANIZATION

STATE DEPARTMENT OF PUBLIC WORKS DIVISION OF WATER RESOURCES

EARL LEE KELLY ______ Director of Public Works
EDWARD HYATT ______ State Engineer

The South Coastal Basin Investigation was conducted under the supervision of

Harold Conkling
Deputy State Engineer

Maps showing the irrigated crops in 1932 were prepared under the immediate charge of the following:

South Coastal Basin

George B. Gleason Senior Hydraulic Engineer

Ventura County

R. H. Jamison Senior Hydraulic Engineer

ORGANIZATION

UNIVERSITY OF CALIFORNIA, COLLEGE OF AGRICULTURE

Cooperating in

South Coastal Basin Investigation

C. B. Hutchison_____Dean College of Agriculture

This report was prepared by

FRANK ADAMS

Professor of Irrigation Investigations and Practice and Irrigation Economist in the University of California Agricultural Experiment Station

and

MARTIN R. HUBERTY

Assistant Professor of Irrigation Investigations and Practice and Associate Irrigation Engineer in the University of California Agricultural Experiment Station

FOREWORD

This report is one of a series of bulletins on the South Coastal Basin Investigation which is in most of its phases confined to the coastal areas of Los Angeles, Riverside, San Bernardino and Orange counties, designated South Coastal Basin. The scope of the present study has been enlarged to encompass Ventura and San Diego counties as well. Most of the field and office work for this bulletin has been on the citrus industry, and there is no line of economic demarcation between South Coastal Basin as above defined and the other two counties.

The report has been prepared by the authors, representing the College of Agriculture, University of California, at the request of the State Engineer and the Los Angeles Chamber of Commerce. It is printed with the consent of Dean C. B. Hutchison of the College of Agriculture.

THE VALUE AND COST OF WATER FOR IRRIGATION IN THE COASTAL PLAIN OF SOUTHERN CALIFORNIA

By FRANK ADAMS1 and MARTIN R. HUBERTY2

CHAPTER I

INTRODUCTION AND SUMMARY

REASONS FOR STUDYING THE VALUE AND COST OF WATER

In most of western United States, including most of California, it has become customary to think of irrigation as the controlling factor in agriculture. This is not because the importance of good soil and favorable climate are not recognized, but because in areas of limited

rainfall, intensive agriculture is not possible without irrigation.

The coastal plain of southern California,3 to which the present report applies, is an area in which an intensive agriculture of a high type has been built up under irrigation. Over 600,000 aeres in the six southern coastal counties is now being farmed, and the annual value of the product of the citrus groves alone approximates one hundred million dollars. Investments in water supply and major irrigation works have already in some eases reached very high figures as compared with investments for similar purposes in most of the other irrigated areas, and it is not improbable that still larger investments will be necessary before the water of even the local watersheds will be fully utilized to the extent that will be economically desirable. water imported by the city of Los Angeles from its Inyo and Mono county sources and the contemplated supply from Colorado River being provided by the Metropolitan Water District of Southern California is intended primarily for domestic, municipal, and industrial purposes, agriculture is already absorbing and may for some years to come continue to absorb a part of the surplus. While the importation of these outside supplies could not be paid for by agriculture alone, its contribution to the cost may be material.

In view of the situation that has been outlined, it is clear that the value and cost of water for irrigation are matters of the utmost importance to the people of the coastal plain of southern California. What expenditure is it worth while for a farmer to make for irrigation water? If it is proposed to provide an irrigation water supply for land not yet developed, what investment can profitably be made for

ment Station.

² Assistant Professor of Irrigation Investigations and Practice in the University of California and Associate Irrigation Engineer in the University of California Agricultural Experiment Station.

¹ Professor of Irrigation Investigations and Practice in the University of California and Irrigation Economist in the University of California Agricultural Experiment Station.

cultural Experiment Station.

³ As used in the present report, the term "coastal plain of southern California" includes the valley and cultivatable foothill and rolling lands of the counties of Santa Barbara, Ventura, Los Angeles, San Bernardino, Riverside, and San Diego, lying on the ocean side of the ranges of mountains which separate the coastal areas from the interior desert areas; also all of Orange County. It is therefore more extensive than the immediate coastal belt which, as will appear in the report, is of special significance in citrus culture.

that purpose? If a proposed water conservation project is desirable because of the general benefits that will accrue to a particular area or to the State, in addition to the specific benefits that accrue to the land on which the conserved water is or will be used, what part of the cost can be charged against agriculture without impairing existing farm values, or without deterring the development of the new lands on which the water might be used?

Although these are all questions which vitally concern the people of the southern California coastal plain, they are likewise questions which concern the State. This is not only because the welfare of the southern California coastal plain is closely related to the general welfare of the State as a whole, but because the State is being called on to assist in further water developments and also because it must pass on the feasibility of irrigation districts organized to make water available for irrigation, on the rates charged for water by public-utility water companies, and on the subdivision and sale of farm lands, which throughout southern California require irrigation.

The State is already directing itself to a thorough study of further water conservation possibilities, especially in the Santa Ana, San Gabriel and Santa Clara River basins, and it is known that opportunities exist for important additions to the present farm water supply through surface and underground storage and rectification of sewage and other city waste waters. Los Angeles County, through the Los Angeles County Flood Control District, is well along on a comprehensive program of flood control through storage, and while intended primarily for flood control, the works being built will conserve the major part of the mountain wastes of the San Gabriel and Los Angeles rivers for irrigation. Perhaps of still greater immediate concern, the Metropolitan Water District of Southern California is now constructing its aqueduct from Colorado River, and for many years to come should be in a position to furnish a large supply of water for use in irrigation.

In any of these enterprises, the value and cost of water for irrigation stands out as among the most important economic factors involved, if not the controlling one.

It will not be presumed in the present report to answer with finality the questions that have been raised, or the numerous other questions that will arise in connection with the value and cost of irrigation water in the southern California coastal plain. Few if any such questions can be answered except in a broad and general way, because the facts on which the answers must be determined are not all available; nor are the principles on which some of the answers must be based fully recognized or developed.

For instance, what a farmer can afford to pay for irrigation water and still maintain a profitable farm enterprise will depend very largely on his investment in land and improvements. It might be argued that he can not afford to pay more than he is now paying, because the value of his investment in land and improvements is already fixed largely by his present water costs. But changing conditions might compel him or permit him to pay more, or conceivably they might enable him to obtain water for less than he is now paying. In either case uncertainties are involved. Even the expression "what the farmer can afford to pay"

is an indefinite one. A farmer might be able "to afford" a certain charge for water which it would not be to his advantage, economically, to pay, because in excess of the value created through the use of the water. The converse of this might also be true.

Again, the amount that can be profitably spent to provide an irrigation water supply for undeveloped lands will depend, finally, on the value water will add to those lands. This in turn will depend on the net income which can be obtained above other costs than for water, and the latter can only be estimated. It will also depend on the value of the undeveloped land without water, and on the necessary costs of preparing the land for planting and for subdividing it. These can be reasonably determined or estimated for particular areas, but this has not been possible in the present study, nor would general determinations or estimates have value.

Still further, the amount a farmer will find it to his advantage to pay for irrigation water is governed somewhat by his standard of living, and to some extent by whether his land is farmed as a means of family livelihood, as a strictly commercial enterprise, to produce part of his home food requirements, or to supplement an income obtained mainly from another source or sources. Which of the latter purposes is to govern might be assumed, but there is no satisfactory basis for assuming a particular standard of living for the farmer, or the income needed to maintain it.1

Because of the indeterminate nature of many of the factors that enter into the value and cost of water, and because the time available for the investigation on which the present report is based has been limited, the objective of the investigation has been restricted mainly to the gathering of information which bears on the question of the value and cost of water in the southern California coastal plain, and to its presentation in such form as may aid in its application to particular situations or conditions. The data presented are thought to justify certain generalizations and some specific conclusions, and these are presented in the concluding chapter of this report.2

[&]quot;It will be apparent that many different considerations enter into the value of water to a farmer and what he can pay for it, but to discuss, or even to attempt to mention, all of them would expand the text of this report unnecessarily in view of its purpose. A few of these other considerations are the size of the farm unit, the efficiency with which the farm is managed, and whether the water in question is needed to supplement an inadequate supply.

It has been suggested that whether a farmer can afford to pay for an additional supply of water as much as his farm income will permit, when taking into consideration other costs and the value of his investment, will depend on whether the capital that will be necessary for using the additional supply of water can be more profitably employed elsewhere.

that will be necessary for using the additional supply of water can be more profitably employed elsewhere.

It is clearly possible that, rather than to destroy an existing investment by going without water, or by reducing the quantity used below the minimum requirements (see footnote, page 19), a farmer will pay for water his entire income above other out-of-pocket costs, with nothing left for interest on land and other related investment. This, of course, may be the situation in the case of the marginal farm.

2 Costs of producing water or prices paid for shares in water companies, although referred to incidentally in the text of this report (table 38 and page 90), have not been considered in connection with the value of water for irrigation, since the primary purpose of the report is to deal with what it is "worth while" for farmers to pay for water, or, expressed differently, what it is "to their advantage" to pay. An interesting paper entitled "Cost and Value of Water in Southern California," presented by Professor Franklin Thomas before the Los Angeles Section of the American Society of Civil Engineers, deals briefly with these subjects. This paper is to appear in Civil Engineering, published by the American Society of Civil Engineers. Those interested from an historical point of view will find it profitable to consult Wm. Ham. Hall, "Irrigation in California (Southern)"; or for later data, the following: C. E. Tait, "The Use of Underground Water for Irrigation at Pomona, California", U. S. Dept. of Agr., Office of Experiment Stations, Bulletin 236, page 90; Harry F. Blaney, "Cost of Water to Irrigators in California", Calif. State Dept. of Public Works, Division of Engineering and Irrigation, Bulletin 8, p. 56, 57.

While in the main, the developed agricultural lands of the southern California coastal plain are operated with the same motive that leads to the cultivation of farm lands elsewhere—that is, to earn both a livelihood and a profit for the operators—questions relating to the value and eost of irrigation water are complicated in southern California by a number of somewhat unusual conditions. One of these is the very wide range of crops grown. Another is the extensive use of agricultural lands for small suburban farms which may be able to pay more for water than farms generally can pay. Where these small farms are near to the cities, or at least reasonably accessible from the industrial centers, the products grown are largely for family sustenance or to supplement the incomes of industrial or other city workers. Higher costs for water than generally will be worth while in farming may also be paid by some of the larger farms which are operated by those who do not entirely depend on the income from the products grown, but have acquired them chiefly for residential purposes. While some thought has been given in the present investigation to the various special conditions mentioned, the chief purpose has been consideration of the value and cost of water from the standpoint of holdings operated to earn a livelihood and a profit for those farming them. or of corporation and individual farms which are operated solely as business enterprises apart from considerations of family sustenance.

While there are still some cases in the southern California coastal plain where water for irrigation is supplied by public utilities, and charges for water are imposed in accordance with some one or more of the principles underlying the fixing of public-utility rates, water is in most cases supplied by mutual water companies, irrigation districts, or private pumping plants, and whatever it costs is the amount that must be paid for it if it is to be used. Values in land tend to become adjusted to these costs. A somewhat different problem arises in connection with the disposal of water brought into southern California primarily for domestic, municipal, or industrial uses and only incidentally for agriculture. Under the latter conditions principles of rate-fixing followed by public utilities may govern the rates for water used in irrigation on farms of the type with which the present investigation chiefly deals. Although the importation of water supplies may lead to some shifts in the utilization of present sources and conceivably may introduce competitive factors where the cost of water from local sources is very high, this problem is not imminent, and has not received specific consideration in the present study.

NATURE AND SCOPE OF THE INVESTIGATION

In an earlier report by the same authors, what were therein termed "permissible annual charges" for irrigation water in upper San Joaquin Valley were determined, chiefly on the basis of cost of production and farm income. In general, this approach is used in the present study. It is recognized, however, that for any one farm the cost of production is not in any sense fixed, but will vary with the prices and amounts of labor and materials used, with the annual and

¹ State of California, Department of Public Works Bulletin 34, "Permissible Annual Charges for Irrigation Water in Upper San Joaquin Valley," by Frank Adams and Martin R. Huberty. 1930.

seasonal needs in such factors as frost protection and disease and pest control, and also with the income as determined by yields and prices of the products grown. It is also recognized that yields may vary as more or less is expended in the various cultural processes, and that there are difficulties in attempting to forecast cultural requirements and prices. It is furthermore clear that water is not independent of the other factors of production, although the quantity needed is a relatively fixed one for any soil or crop or climatic condition, and not subject to variation in the same degree as other materials if the orchard is to be maintained in normal condition. Nevertheless, the cost-of-production approach, although generally recognized as of doubtful value in certain types of farm economic studies, is considered a justifiable and practical means of studying certain phases of the value of water for irrigation and of water costs which it is worth while for growers to pay. In using this approach, it is, of course, necessary to assume that costs other than for water are measurable in terms of established practice, and that with adjustment of both costs and income to price levels consistent with the outlook for the future. a basis is furnished for estimating within useful limits the residual income over other costs than for water. While, as will appear later, the cost-of-production and yield records used in the present study cover the wide range usual in farming everywhere, it is possible. either by accepting the costs as they appear in the records, or by amending them in some particulars when the trend in expenditures justifies, to arrive at a range of costs which may reasonably be considered representative for the local areas or districts to which they are applied.

In the present study conditions are far more complicated and the range of values far greater than in upper San Joaquin Valley, to which the previous report mentioned applied. It has therefore been found necessary in the present study to go into matters not dealt with, or dealt with only in a limited way, in the upper San Joaquin Valley study.

For instance, in the coastal plain of southern California more attention needs to be given to the effect of the cost of irrigation water on the use and value of the land, and more weight needs to be given to local differences in soil, topography, climate, frost hazard, and fertilizer requirements. Also, taxes are a larger part of the total cost of production, especially, as is not infrequently the case, where the agricultural areas are embraced within the limits of the incorporated cities. The relatively large extension of subdivisions into the commercial agricultural areas, already mentioned, is another complication. Finally, there arises the question of the unused lands, shifts from one type of so-called permanent culture to another, such

¹According to the findings of the Division of Irrigation Investigations and Practice of the University of California, the minimum water requirements are met if the moisture in the soil is maintained above the wilting point and the maximum requirements are met if the soil moisture is kept safely above the wilting point. Adding water when the moisture content is safely above the wilting point will not add to the quantity or the quality of the yield. These conclusions have been found to hold for deciduous and citrus trees and vines. It may be admitted that reducing the moisture content of the soil below the wilting point will reduce yield; also that doing this when the trees are not using much water may be possible without costing more in reduced yields than the water withheld would cost. The statement in the text, however, is generally true, because the general practice under good orchard management is to keep trees growing normally.

as from walnuts to citrus, and the local differences in water requirements due to the differences in rainfall and temperature. While all of these special conditions have not been specifically considered, most of the more important of them have been.

SOURCES OF DATA AND PROCEDURE IN FIELD STUDY

As in the previous study referred to, the authors have in the present study received the hearty cooperation of the Agricultural Extension Service of the University of California, and have been supplied by that service with approximately 100 records of cost of production and yield obtained by the farm advisers in farm enterprise efficiency studies. The California Citrus League, through F. O. Wallschlaeger, has also extended its cooperation and has given the writers access to their cost-of-production and yield records, from which 3- to 5-year records for some 900 citrus groves have been taken for study. More than sixty local citrus packing houses have furnished summaries of the yields of their grower members, and of the prices paid such members for their products. Similar information has been given for the walnut packing houses by the California Walnut Growers' Association, through A. W. Christie. Mr. Floyd D. Young, Senior Meteorologist, in charge of the frost protection service of the United States Weather Bureau, has supplied detailed data as to the frost hazard in the various portions of the area studied, and the farm advisers of the six southern counties, the citriculture specialist, and other members of the staff of the College of Agriculture, have cooperated freely in assisting the writers to obtain an understanding of the cultural and economic problems involved in the agriculture of the southern California coastal plain. About two-thirds of the groves for which cost-of-production and yield records have been used have been visited by the writers and an attempt made on the ground to correlate soil, climatic, and cultural factors with the conditions of the groves and the yields being obtained. Data regarding present costs of irrigation water have been obtained from a previous publication of the State Department of Public Works,2 brought down to date by direct inquiry; also from the cost-of-production records above mentioned. Figures regarding bare-land and developed-land values have been obtained in conference with numerous agencies and individuals. Information as to crop acreages has come both from the Federal-State Cooperative Crop Reporting Service and from the county horticultural commissioners. Finally, material assistance has been received from the Division of Water Resources. State Depart-

¹ The following members of the field staff of the Agricultural Extension Service have materially aided the writers, in field trips or in conferences, or both: Warren R. Schoonover, extension specialist in citriculture, Riverside; V. F. Blanchard, farm adviser, and T. R. Merryweather, assistant farm adviser, Ventura County; M. B. Rounds, farm advisers, and M. H. Kimball, W. H. Williams and A. G. Salter, assistant farm advisers, Los Angeles County; H. E. Wahlberg, farm adviser, and assistants, Orange County; H. J. Wilder, farm adviser, and assistants, San Bernardino County; M. M. Winslow, farm adviser, Riverside County; and J. G. France, farm adviser, and J. C. Miller, assistant farm adviser, San Diego County. Dr. Harry R. Wellman, specialist in agricultural extension, Berkeley, has been frequently consulted regarding the price outlook for southern California farm products. Mr. A. Shultis, of the Berkeley office of the Agricultural Extension Service, has aided in the interpretation of Agricultural Extension Service records.

2 State of California, Department of Public Works Bulletin 36, "Cost of Irrigation Water in California," by Harry F. Blaney and Martin R. Huberty. 1930.

ment of Public Works, both financial and in the matter of furnishing maps showing present irrigation development.

REGIONAL AND LOCAL DIFFERENCES RECOGNIZED

There are numerous regional and local differences in the southern California coastal plain which it is desirable to recognize in a study such as the one in hand.

In the first place, there are three more or less distinct areas which are separated geographically and as between which physical conditions are sufficiently unlike to justify separate treatment. Again, there are within these three main subdivisions local differences which need to be taken into consideration. Finally, the entire southern California coastal plain is subject to broad climatic differences which extend through its length from San Diego to Santa Barbara. All of these differences have been more or less recognized in this study, and are taken into account in this report where helpful in presenting the data collected, and in summarizing the results and drawing conclusions.

The three main divisions of that portion of the southern California coastal plain which has been covered by the present study are (1) the coastal plain of Ventura County, chiefly comprising Santa Clara River Valley and the Oxnard plain; (2) the area extending from Los Angeles easterly and southerly through Los Angeles, San Bernardino, Riverside, and Orange counties, and designated by the Division of Water Resources as the south coastal basin; and (3) the coastal plain in San Diego County. The coastal plain of Santa Barbara County is comparable with that of Ventura County, and with the latter makes up the most northerly portion of the southern California coastal plain. The present investigation has not, however, extended to Santa Barbara County, nor has it extended to San Fernando Valley, which is part of the south coastal basin as defined by the Division of Water Resources, nor to San Jacinto River basin in Riverside County. It was believed that the problem in hand could be adequately studied for the entire coastal plain without specifically including data from these areas.

In the first of these areas, the water supply in the main comes from a single source, namely, Santa Clara River and tributaries. Problems of water supply are rather closely interrelated, the soils are mostly of a single series, an unusually large number of the holdings are of sufficient size to permit economical operation, and there is a minimum of small and semisuburban holdings. In the south coastal basin the water supply comes from three entirely distinct major sources, and the use from one of these has little relation to the use from either of the others; the soils vary far more widely; the number of farms too small to be operated most economically, and the number of semisuburban acreages is much larger; and the types of farm enterprises are far more numerous. In the San Diego County coastal plain, water supplies are more limited than in either of the other two divisions, the agricultural lands are less compact, and the areas of agricultural lands are far more limited.

No single criterion has been used in outlining the local areas within these three main parts of the southern coastal plain as segregated for the purposes of the present study. To some extent geographical location has been a consideration, but in the main they have been outlined according to local climatic differences, together with topography, soil, vigor of trees, and yields. Boundaries between some of these subdivisions have been easy to draw, but in other cases the segregations have been somewhat arbitrary.

The broad elimatic differences which run throughout the southern California coastal plain are chiefly of significance in connection with the growing of citrus fruits, and are based mainly on differences in average mean maximum August temperatures. Having in mind the southern California citrus belt, Vaile has laid out the following main climatic zones:1 coastal zone, including most of Orange County and the Whittier and La Habra sections of Los Angeles County; intermediate zone, including San Gabriel-Pomona Valley; and interior zone, including San Fernando, Fillmore. Redlands, Highlands, and Riverside districts. This segregation only in part covers Ventura County and does not extend at all to San Diego County. In order to make this zoning complete, the writers have extended the segregation in Ventura County by classing the areas in Santa Clara River Valley south and west of Saticov as coastal and those from Saticov eastward through Santa Paula, also Santa Rosa Valley, as intermediate. Furthermore, Piru and Ojai and Simi valleys have been included with Fillmore as interior. In San Diego County, Chula Vista, National City, Bonita, and San Diego districts are considered as coastal, and El Cajon, Escondido, Vista, and Fallbrook as intermediate.

CROPS CONSIDERED

The crops chiefly taken into consideration in the present investigations have been Navel and Valencia oranges, lemons, and walnuts, since it is only for these that it has been possible to obtain records of cost of production and yield of sufficient completeness to furnish a basis for the approach to the problem under study that has been There are, of course, many other important products mainly used. grown in the southern California coastal plain, and for a few of these —grapefruit, avocados, deciduous fruits, beans, and sugar beets limited records of acreage costs and income are available. For truck, alfalfa, and field crops other than beans and sugar beets, it has been possible to consider the problem of water costs only on the basis of what growers are now paying, and what has been found to be reasonable elsewhere. This latter method of approach has, in fact, been used partly for deciduous fruits, beans, and sugar beets. The maximum number of years for which records for citrus fruits have been used is six, and for walnuts, five, and in studying these crops no records covering less than three years have been included.

It can be stated generally with reference to decidnous fruits, alfalfa, and field crops that they will be grown permanently in the southern California coastal plain only where conditions are not favorable to citrus fruits, walnuts, and other crops of comparable high value. This is because the high land values will restrict production to the crops which give the greatest return. Since the larger part of the area is already in some one of the higher-priced crops referred

¹ Vaile, Roland S., A Survey of Orchard Practices in the Citrus Industry of Southern California, Calif. Agr. Exp. Sta. Bul. 374, page 6.

to, the value and cost of water for such crops constitute by far the most important phase of the problem. However, the problem of the value and cost of water for crops which give a much smaller gross income is important. This will be discussed in the final chapter of this report.

BASIC CONSIDERATIONS UNDERLYING STUDY OF THE VALUE AND COST OF WATER FOR IRRIGATION

It has already been stated that for the problem in hand the most satisfactory approach has been considered to be through cost of production and income of the farmers in the area under study, the general objectives being to determine the amount of the residual income above that required to meet costs of production and maintain productive capacity, and to consider this residual income in relation to value and cost of water. No one method of gathering or interpreting cost-of-production and income data fits all problems. The methods followed must depend in a measure on the purpose in mind.

Items Included in Cost of Production.

The first problem is to determine what shall be counted as costs of production. There is general agreement among specialists in the field as to certain items. These include labor hired, costs of materials, depreciation of equipment and improvements other than those which have become part of the land itself, and eash costs of a necessary nature, such as for taxes, general expenses, machinery, and insurance.

These are all counted as costs in the present study.

Allowance for work done by the farmer and members of his family, at rates paid other labor, is included in most cost-of-production studies and is in the present one. Allowance to the farmer to cover superintendence or management in addition to allowance for actual work done by him at the going wage is less frequently included as a eost, although superintendence and management paid for, as in the case of larger individual and corporation holdings and even smaller holdings where the owner employs a foreman or superintendent at rates of pay higher than the prevailing wage scale, is enstomarily included. The cost-of-production records supplied by the Agricultural Extension Service which have been used in the present study do not include payment for superintendence or management by the owner. On the other hand, the Citrus League records used do in some cases include an allowance for labor which would be considered superintendence or management, because under the procedure followed by the Citrus League in gathering the records it has not been practical to eliminate it. Owners have been inclined to claim for their time amounts which they believed they were entitled to, without differentiation between labor and management. Ordinarily, they considered their time worth \$100 per month, although this has been scaled down in the case of holdings under 20 acres. On a citrus grove of that size it is probable that the owner can not be profitably employed in actual labor more than half or two-thirds of his time; on a strictly "enterprise efficiency" basis the findings are that the time would be The result of including in the labor item in some of the Citrus League records this additional amount is to make the total cost of labor a little higher than in the case of the Agricultural Extension Service records. Since the latter ordinarily include only time actually spent in the specific operations reported, without allowance for "between-job" time, the Citrus League figures may be expected to represent more nearly the normal full farm labor cost than do those of the Extension Service. As a practical matter, however, the differences have not been found material in most of the areas for which records from both agencies have been used. The average difference for oranges has been found to be \$6 an acre and for lemons, \$9.60, the higher figures in each case being for the Citrus League records.

There are no set rules for including as a cost depreciation on improvements which are definitely a part of the land itself. These include original levelling, ditching, irrigation pipe lines, and drainage lines. Decision has been reached in this study to consider the improvements such as original levelling as part of the land and not subject to depreciation, but to make allowance for depreciation in the other items mentioned; also to make allowance for depreciation of "permanent" plantings, which in the present report means trees, vines, and alfalfa. If the problem under consideration were primarily a determination of a basis for rate-fixing, the investment sunk in the land, such as for levelling, would, of course, deserve consideration. As stated, however, it seems more logical in the present study to count such improvements as part of the land.

Because the cost-of-production data used in the present study have come mostly from the California Citrus League and the Agricultural Extension Service of the University of California, the only practical course, with one exception, has been to adopt the depreciation charges as given in their records, though there has not been uniformity in the rates applied or in the valuations for purpose of computing depreciation. The exception is in the case of trees. This item is not included in the Citrus League records, but is an important item in those furnished by the Agricultural Extension Service. The amounts allowed for depreciation will appear in the discussions pertaining to the several crops studied. In the case of citrus trees the same allowance has of course been applied to the Citrus League and the Agricultural Extension Service records.

Since the objective in using cost-of-production records is, in the first instance, to obtain the residual income over other costs than water, both the costs of water and allowances for depreciation on the equipment used in supplying water, such as irrigation wells and pumping equipment, have been eliminated.

Another important item about which question arises is that of interest on investment in land and improvements. This is not included as a cost in the Citrus League records, but is included in those of the Agricultural Extension Service. The principle adhered to by most economists is that interest on land and on investments sunk in the land, such as for original leveling and drainage, is not properly a cost of production, and that principle is adhered to in this report.¹

Land is not reproducable, whereas, the other items included are reproducable at some cost. The amount paid for land for improving it does not affect its productivity or determine its value. The value of land arises from the amount it will produce over and above the cost of operating it, including depreciation on the improvements which have been made on it for the purpose of increasing its natural productivity.

Eliminating interest on land as a cost does not, of course, mean that it does not need to be considered in connection with the value and cost of water. The direct bearing of interest on investment, including investment in land, has been already pointed out, and there will be frequent occasion to refer to it in the later pages. Regardless of the theoretical basis for excluding interest on land as a cost, the impractieability of arriving at values on which interest on land might be figured rules the item out in the present study. With reference to this item, however, it is recognized that in any agricultural area there is always some land which does not yield sufficient income to pay interest on the investment. It is furthermore true that land already developed which does not pay interest on the investment will tend to stay in production provided the returns are sufficient to cover necessary out-of-pocket costs, a living wage to the operator, and This is due partly necessary upkeep of improvements and equipment. to hope of profit in the future, such as from higher prices or increment in land value, partly to the income accruing to the operator, and in some cases to the fact that continuing in production planted land which can earn annual ont-of-pocket eosts, a living wage to the operator, and upkeep, but not interest on the land, offers the most promising way of salvaging the investment in trees.

While in theoretical considerations of costs of production economists do not ordinarily include interest on investment in land and improvements sunk in the land as a cost, they do include interest on equipment and improvements not sunk in the land. In the present study it has seemed most practical not to treat as a cost interest on equipment and improvements not sunk in the land.

Interest on equipment in citrus and walnut orchards is not ordinarily large, and its inclusion or exclusion would not materially affect the conclusions reached in the present study. It would, however, have been included if there were a feasible basis for doing so. Investment in trees, which in the case of citrus and walnuts constitute the principal improvement not sunk in the land, is, however, large, so that in the final analysis of the report it is given consideration, even if not counted as a part of the cost of production.

Adjustments in Costs of Production and Yields to Changed Price Levels.

As has been previously indicated, the cost-of-production records on which the present study is chiefly based are for the years 1926 to 1931, inclusive. Labor and material costs have been substantially reduced since or beginning with 1931, and it seems appropriate to assume that a lower price scale than that which obtained in the period 1926–1931 will be in effect during the years just ahead. It has therefore been necessary to make adjustments in the items covering labor and material to price levels which it seems reasonable to anticipate for the future. This involves a certain amount of speculation, especially in view of the recent inflationary measures that have been enacted by Congress, but it can not be avoided. For the purpose of making

¹ Many of the citrus and walnut growers of southern California, especially many of the citrus growers, hire work done which requires special and expensive equipment, such as for spraying and fumigation, and frequently also cultivation. In such cases the charges paid presumably include an amount for interest on the equipment used, although not specified.

these adjustments, prices paid for labor and for materials used in growing the principal southern California crops have been obtained as of 1932. Prices for labor and materials have been assumed which fall between the averages of the years 1926–1931 and the year 1932. Uncertainties as to the future eliminate the need for attempts to arrive at statistical refinement. In general, the unit prices for labor in citrus and walnut production adopted in the study are 40 cents an hour for such operations as pruning, frost protection, tree care, and tractor driving, and 30 cents an hour for irrigating and miscellaneous labor. Unit prices used for materials have been reduced 20 to 30 per cent from those paid in 1929. The percentage reduction applied in connection with each crop will appear in the separate discussions of those crops. Furthermore, a more detailed presentation of the data from which the reductions made have been computed is included in the appendix. (Table F.)

Taxes are another cost which it is generally coneeded will be reduced. The amount of reduction will, of course, not be uniform between the different areas, largely because of the differences in the fixed obligations which must be met by taxes. The only practical procedure in the present study is to assume a flat percentage reduction in each of the areas and to use what seems to be a conservative figure. Pending state-wide proposals are for reductions ranging from 25 per cent to 50 per cent, but owing to the large percentage of fixed obligations in the areas covered, the net reductions to the farmers perhaps can not be as great. It is considered reasonable in the present study to assume a flat percentage reduction from the average taxes paid during 1926 to 1931 of 15 per cent, and this has been done.

While reductions in eosts of production will result most largely from lowered unit costs of labor and materials, the lower prices which growers are expected to receive for their products in the years immediately ahead are expected to result in some reduction in the amount of labor and materials applied. Under conditions as adverse as those of 1932 reduction in the amounts of labor and materials used might be carried so far as to lower yields appreciably, but the writers do not feel warranted in assuming that over a period of years the average production will be materially if at all below the average growers have maintained from 1926 to 1931. Therefore, in setting up the data obtained, the yields shown by the records will be considered applicable to the future. Some authorities hold that the recent high prices for citrus fruits and walnuts have led to some production expenses that have not brought compensating increases in yields, and that material reductions can be made in inputs of labor and materials without adverse effect on yields.

Summarization of Statistical Data.

A common difficulty in the presentation of statistical material is selection of the basis on which it is to be summarized. The principal cost-of-production and yield data assembled in the present investigation, and presented in tables A, B, C and D in the appendix, cover not only a wide range of physical conditions, but also a wide range of costs and yields. Subdivision of the southern coastal plain into a number of areas on the basis, chiefly, of climatic and soil differences

has made it possible in summarizing the data to eliminate the principal inconsistencies due to physical factors which would arise if these differences were not taken into account. While summarizing the data by separate areas limits to some extent the options in statistical analysis, it makes possible a more truthful presentation of costs and yields in the various districts of the southern coastal plain, and facilitates the application to particular situations of the conclusions reached.

Of the various methods of summarizing statistical material, three have been considered, viz: to show the median, the mode, or the average. None of these has seemed wholly satisfactory. Of the three, the average seems most appropriate, yet neither this nor the median nor the mode takes sufficiently into account costs and yields on farms which fall within the marginal range, and these need to be considered. Because it is considered preferable to the median or the mode, conclusion has been reached to use, in part, the average in summarizing most of the data which follow. However, instead of ascertaining the averages for all growers in any area, it has seemed best, when using averages, to eliminate the upper and lower quarters and to make the averages relate only to the middle half of the growers. This plan is followed because in some of the areas the range in the upper and lower quarters is so erratic as to reduce the representativeness of the averages. If the number of records available for the different areas varied less widely, the averages would not be confined to the middle half alone.

While average figures are customarily used by the public generally in connection with such matters as costs of production and yields, they do not satisfactorily represent as large a proportion of growers or conditions as it seems desirable to take into account in a study of

the value and cost of water for irrigation.

For instance, the average grower might find it worth while to pay \$30 an acre a year for water for irrigation. This would then be more than half, or approximately half, of the amount the growers might find it to their advantage to pay. So far as this report is concerned with what it is worth while to pay for irrigation water, or with "permissible" irrigation costs when used in this sense, the usefulness of the report, it is believed, would be reduced if the data assembled were summarized only in such a way as to show the situation of the average farmer in each area. Therefore, in addition to showing the average costs of production and yields in summaries presented in the succeeding chapters, there are also shown the costs of production and yields of the least favorably situated growers in the upper two-thirds group. Costs for water which they will find it worth while to pay, or values

The median of a group of values arrayed in order of magnitude, as 1, 5, 7, 9, 11, 15, and 17, is the middle one; that is, in this case, 9. The value of the median is due entirely to its position in the array and is not affected by the magnitude of the other values in the array, all of which are taken into consideration in an average. For instance, if the above array of figures were changed to 2, 6, 7, 9, 11, 60, and 100, 9 would still be the median. The average of the first array, however, is 9.3 and of the second, 27.8.

The term "mode" is used in statistical procedure to represent the particular value in a series which occurs the largest number of times. For instance, if 5 citrus growers have a cost of production of \$100, 7 of \$120, 2 of \$130, and 5 of \$140, \$120 is the mode. That is, a cost of \$120 occurs the largest number of times. Where a certain value occurs much more frequently in a group than any other value, the mode is clearly the most representative value, but is not satisfactorily representative unless this is the case. In the summaries of costs of production and yields given later in this report, only a few include a sufficient number of records to bring out a satisfactory mode, except in some of the "frequency distribution" summaries given, which will be referred to later.

which may be given to the water they use, will obviously not be too high for the "bulk" of the growers.

SUMMARY

The final chapter of this report is devoted to an analysis of the statistical and other data that are presented in Chapters II to VI. That chapter, therefore, forms the principal summary of the report. However, the following brief recapitulation of the main considerations of the report indicates the nature of the information assembled and something of the manner in which it can be applied to the practical question of how much it is "worth while" for the farmers of the coastal plain of southern California to pay for irrigation water.

- (1) Nine hundred thirteen 3- to 6-year cost-of-production and yield records for eitrus fruits collected by the California Citrus League and the University of California Agricultural Extension Service and eighty-four 2- to 5-year records for walnuts collected by the Agricultural Extension Service have been assembled and analyzed, primarily with a view to computing the amount of residual income the citrus and walnut growers of the coastal plain of southern California can expect to receive above other costs than the cost of water. These data are presented and discussed in Chapters II and III. Less detailed information of the same or similar nature for deciduous fruits, vines, field crops, and truck crops is given in Chapter IV. Before analyzing the data relating to cost of producing citrus fruits and walnuts, such downward revisions in costs were made as seemed appropriate in view of lowered price levels.
- (2) Fifteen separate 'areas' for oranges, seven for lemons, and four for walnuts are set up for the purpose of analyzing the statistical data obtained for these crops. The segregation of these 'areas' is based on broad climatic differences and on local environmental and physical factors such as soil, topography, and frost, wind, disease, and insect-pest hazards. The physical characteristics of these separate 'areas' are set forth in some detail, chiefly in the appendix.
- (3) The residual income from eitrus fruits and walnuts above other costs than the cost of water is found to vary significantly as between the lemon and the walnut and as between a number of the orange areas. Study of the data by these "areas" indicates clearly that regional and local differences affect the amount it is worth while for farmers to pay for irrigation water. Frequency distributions show very wide ranges in costs of production, yields, and residual income within the separate "areas."
- (4) Average annual costs reported in the cost-of-production records assembled, as well as water costs being paid under typical irrigation companies or districts in the southern California coastal plain, are given and discussed. The highest "area" average annual water cost reported in the cost-of-production records for citrus fruits is \$43.09 an acre: the lowest, \$16.63 an acre. For lemons the highest and lowest "area" averages are \$49.82 and \$22.24 an acre, respectively, a year; for walnuts, \$14.32 and \$11.00. Only one-third of the orange groves covered by the cost-of-production records have an annual water cost under \$18 an acre; only one-third of the lemon groves reported have an annual water cost below \$24 an acre. Some individual citrus growers report average

annual water costs exceeding \$75 an acre; a few report annual water costs exceeding \$90 an acre.

In connection with the data relating to amounts being paid for water, information is presented regarding the amounts of water used. Investigations directed to determination of the water requirements of citrus fruits in the southern coastal plain are cited and the results given briefly.

- (5) The undeveloped agricultural lands of the southern California coastal plain are listed and described from the viewpoint of crop adaptability. The final summary of the undeveloped lands shows an estimated net area of 470,000 acres available for extension of agriculture in the southern California coastal plain from San Diego County to Ventura County, exclusive of San Fernando Valley and San Jacinto Basin. The area estimated as "available" for the extension of citrus fruits in the same districts is 169,000 acres. Of the latter, 72,000 acres is in western San Diego County and the southern tip of Orange County, 51,000 acres in the South Coastal Basin, and 46,000 acres in Ventura County. These areas include some land now in annual crops. Terming this area "available" for citrus fruits does not mean that it is all high-grade land, since much of it is not.
- (6) The cost of water is only one of a number of items of expense that enter into the cost of producing an agricultural crop and there is no fixed amount which a farmer "can pay" for water.

The owner of an established farm, in order to maintain his planting, may be willing and find it to his advantage to pay such a high charge for water that nothing is left out of income to pay for the use of the land itself; that is, nothing remains to apply to interest on the farm investment or to profits.

On the other hand, the assumption is made that the investment necessary to bring new land into production is not likely to be risked unless there is reasonable prospect of sufficient return above costs to maintain a value in the land equal to the investment in it, including the cost of necessary improvements and equipment.

The data relating to residual farm income above other costs of production than the cost of water presented in the report indicate the extent to which the farm income in the different areas or districts is likely to be sufficient to maintain a value in the land irrigated equal to the investment in it.

(7) While information on what established farmers are paying for water is of general value in connection with estimating charges for water those who develop new land will be likely to obligate themselves to pay, such information, even when supplemented by data regarding residual income above other costs than the cost of water, is not conclusive.

However, since some will desire to use charges established farmers are paying for water as a basis for determining the feasibility of new water-development projects, summary tables are given which show the minimum, average, and maximum water charges reported in the cost-of-production records assembled, and also the residual income above other costs than the cost of water at certain specified selling prices for oranges, lemons, and walnuts. (Tables 54, 55, and 56.)

(8) Under the assumption that new land will not be developed unless there is reasonable prospect that the income from it will be sufficient to pay all necessary annual costs of production and still maintain a value in the land equal to the investment in it, including the costs of necessary improvements and equipment, the amounts that it will be to the advantage of the farmers who develop the land to pay for water will depend on other costs of production and on the cost of the land.

Since the value of the farm investment is a result of net income obtained or expected, and since the latter is determined by costs of production and the prices received or to be received for the products grown, costs of production, yields, cost of land, improvements and equipment, and prices to be received all enter into the question of the

charges to be assumed or imposed on land yet to be developed.

Believing that the cost and yield records assembled in the investigation are representative of the southern coastal plain, tables have been prepared which show, by "areas," the prices which must be received for oranges, lemons, and walnuts if costs of production other than the cost of water delivered on the land, interest on assumed investment in land, improvements, and equipment, and specified annual charges for water delivered on the land are to be met, these specified water charges being \$10 to \$60 an acre for oranges and lemons and \$5 to \$40 for walnuts. (Tables 57, 58, 59, and 60.)

These tables show that, for the data presented, the following prices for oranges, lemons, and walnuts will be necessary to meet the items

listed in the preceding paragraph:

A. To the grower of average residual income: Oranges, \$1.94 to \$2.58, f.o.b., per packed box; lemons, \$2.69 to \$3.54, f.o.b., per packed box; walnuts, 8.1 to 21.4 cents per pound, net to the growers.

B. To growers of least residual income in the upper two-thirds group of growers: Oranges, \$2.10 to \$2.77, f.o.b., per packed box; lemons, \$2.72 to \$4.81, f.o.b., per packed box; walnuts, 9.6 to 23.7 cents per

pound, net to the growers.

(9) The price outlook for the products to be grown on undeveloped land when provided with an irrigation water supply is one of the very important factors to be taken into account in estimating the amounts those who farm such land will find it to their advantage to pay for water.

Under the present unstable price outlook for the products which most largely determine the value of water for irrigation in the coastal plain of southern California, estimates of the amounts farmers 'ean pay' for water for the remaining undeveloped lands are not considered advisable. However, with prices for oranges, lemons, and walnuts falling within the ranges shown in Tables 57, 58, 59, and 60, those tables indicate within what are believed to be reasonable limits of accuracy the amounts that 'ean be paid' for water in the various areas with costs and yields as shown by the records assembled, and under such assumptions as it is desired to make regarding the amount of the farm investment.

(10) Residual income is shown for other crops than citrus fruits and walnuts to a limited extent only. The amounts being paid for water for these other crops seem to fall most frequently within the range

of \$10 to \$20 an acre a year. The proximity in southern California of large markets for such products as deciduous fruits which are consumed fresh, table grapes, alfalfa, and truck crops, gives local growers some advantage over those situated at greater distances. Residual income above other costs than the cost of water should therefore be a little higher than in areas less favorably situated with reference to local markets, such as San Joaquin and Sacramento valleys. Lima beans have been locally looked upon as a profitable crop with higher water costs than are normally paid in the case of field crops in most of California. Sugar beets are an important crop in a number of districts in the southern coastal plain. However, not sufficient information regarding either present water costs or residual income above other costs for sugar beets has been gathered in the investigation to warrant generalizations regarding the amount it is to the advantage of growers to pay for irrigation water.

CHAPTER II

COSTS OF PRODUCTION, YIELDS, AND INCOME, CITRUS FRUITS AND AVOCADOS

THE CITRUS INDUSTRY IN THE COASTAL PLAIN AREAS OF SOUTHERN CALIFORNIA

The products most widely grown and of largest value in the coastal plain areas of southern California are citrus fruits, that is Navel and Valencia oranges, lemons, and grapefruit. The portions of the six southern counties to which the present study applies have 79 per cent of the total orange acreage of the State and 37 per cent of the total orange acreage of the United States. The bearing lemon acreage in these six counties is 90 per cent and the nonbearing acreage 77 per cent of the total State acreage, while 97 per cent of the total lemon acreage of the United States is in California. Thirty-five per cent of the bearing and 65 per cent of the nonbearing California grape-fruit acreage is in the six southern coastal counties, although most of the grapefruit acreage in Riverside County is outside of the coastal plain.

That the citrus fruit industry is of very great economic importance in the six southern coastal plain counties of California is shown by the fact that the annual f.o.b. value of the product has in recent years generally exceeded one hundred million dollars. Irrigation is required in the production of all of these fruits in California and the amount paid by growers for water represents a large item in the total cost of raising the product. The amount it has been necessary to pay for water, however, has not as a rule been the limiting factor in the extension of the citrus areas. In most cases the ability to obtain water has governed, and the same situation still generally exists in those sections of the southern coastal plain that have undeveloped land suitable and favorably situated for citrus culture. However, the lower prices growers are now receiving for their product makes the amount it is worth while for them to pay for water of increasing importance.

It is not one of the purposes of the present report to discuss in detail the economic outlook for agricultural products grown in southern California, yet it seems proper to consider the situation in a general way because of its bearing on the value and cost of water in the citrus areas in the future.

The Washington Navel oranges grown in California are harvested during the winter and therefore come in direct competition with the output of Florida, Texas, and Arizona. Production is increasing in each of these three states. For instance, the shipments of winter oranges from Florida have increased an average of 545,000 boxes a year during the last decade. On the other hand, Navel production in California has about reached its peak, since nearly all of the California Navel acreage is in full production.

The Valencia orange crop of California is marketed in the summer and is therefore in a more favorable position than the Navel crop with reference to competition from other parts of this country. However, production of summer oranges in South Africa and Australia has been on the increase.

There are about 23,000 acres of nonbearing Valencia oranges in the six southern counties. The average annual increase in the California production of Valencia oranges has been about 700,000 boxes since 1921.

The bulk of the California grapefruit from the area under consideration in the present report is marketed between February and September, with the peak output in July. The bulk of the grapefruit from Florida, Texas, Arizona, and the other districts in California is marketed during the months of October to May, with the peaks of Florida. Arizona, and interior California production coming in March, and that of Texas from November to January. This would seem to place the grapefruit industry of the southern California coastal areas in an excellent position relative to the other areas of the United States. However, large quantities of the Florida grapefruit crop are being canned, thus bringing them into competition with the summer crop in California. Furthermore, while California has a total of only about 17,000 acres of grapefruit, bearing and nonbearing, there are about 95,000 acres in Florida, of which less than 40 per cent is in full bearing, about 86,000 acres in Texas, with only about one-quarter of them producing, and about 14,000 acres in Arizona, with only about one-third in bearing.

Tables 1. 2, and 3 show the acreage of bearing and nonbearing oranges, lemons, and grapefruit in the six southern coastal counties in 1932, and Table 4 shows the total annual f.o.b. value of citrus fruits for those counties for the years 1927–1931. Both Navel and Valencia oranges brought the highest average f.o.b. prices of record during the seasons of 1927–28 and 1929–30. While the average price received for lemons in 1929–30 was the highest of record, the 1927–28 average was 32 cents below the maximum. The average f.o.b. price in 1931–32 was the lowest in 15 years, in the case of Navels, and in 18 years in the case of Valencias. The average lemon price in 1931–32, however, was somewhat higher than the low of recent years, viz: \$3.75 per packed box, as against \$2.59 in 1923–24 and \$3.27 in 1925–26.

CITRUS AREAS COVERED IN STUDY OF THE VALUE AND COST OF WATER

Earlier in this report (pages 21 and 22) attention was called to the desirability of recognizing regional and local differences in the southern California coastal plain in studying the value and cost of water. It was brought out that these differences are based not alone on broad climatic variations, but also on such other factors as topography, soils, vigor of trees, and yields, with geographical location entering to some extent into the segregation. The need of recognizing regional differences has been especially marked in connection with citrus fruits.

ESTIMATED ACREAGE OF ORANGES IN THE SIX SOUTHERN COASTAL PLAIN COUNTIES OF CALIFORNIA, 1932.

County Los Angeles Orange Riverside Riverside San Ulernardino San Diego	Navels 15,828 917 12,383 29,658 939 1,599	Pea Valencias 26,678 47,051 3,849 8,958 8,958 8,958 6,141	Bearing Miseellaneous 51 838 83 1,873 830 1,873 41	Total 43,014 (8,051 16,862 40,88 3,326 7,767	Per cent of California bearing acreage 23.4 23.4 8 2 21.0 19.7 19.7 19.7	Navels 264 13 703 1,170 138 604	Nonbearing Valencins 3,036 12,048 5,76 1,364 2,682 2,682 3,113	Miscellaneous 0 0 0 113 103 73	Total 3,300 12,001 1,392 2,544 2,893 3,723
Totals	61,324	95,007	3,208	159,539	77.7	2,892	22,819	202	25,913

¹ From "Acreage estimates, California fruit and nut crops, 1927 to 1932," issued by California Cooperative Crop Reporting Service, Special Publication 117.

¹ Does not include plantings made in 1932.

TABLE 2 ESTIMATED ACREAGE OF LEMONS IN THE SIX SOUTHERN COASTAL PLAIN COUNTIES OF CALIFORNIA, 19321

County	Bearing	Per cent of California bearing acreage	Nonbearing ³
Los Angeles Orange Riverside San Bernardino San Diego Ventura	11,066 6,855 3,332 4,595 4,760 6,512	26 75 16.57 8 05 11 10 11 50 15.74	325 918 42 157 837 33,496
Totals	37,120	89 71	5,775

¹ From "Acreage estimates, California fruit and nut crops, 1927 to 1932," issued by California Cooperative Crop Reporting Service, Special Publication 117.

* With exception of Ventura County, does not include plantings made in 1932.

* From V. F. Blanchard, Farm Advisor, Ventura County.

TABLE 3 ESTIMATED ACREAGE OF GRAPEFRUIT IN THE SIX SOUTHERN COASTAL PLAIN COUNTIES OF CALIFORNIA, 19321

County	Bearing	Per cent of California bearing acreage	Nonbearing ²
Los Angeles Orange Riverside San Bernardino San Diego Ventura	565 151 21,485 1,868 180 66	8.2 1.24 12.2 15.3 1.5 0.54	218 184 *1,867 582 95
Totals	4,314	38 98	3,101

¹ From "Acreage estimates, California fruit and nut crops, 1927 to 1932," issued by the California Cooperative Crop Reporting Service, Special Publication 117.

² Does not include plantings made in 1932.

³ Mostly in Coachella Valley, outside the southern coastal plain.

TABLE 4

TOTAL ANNUAL F. O. B. VALUE OF CITRUS FRUITS FOR THE SIX SOUTHERN COASTAL PLAIN COUNTIES OF CALIFORNIA. 1927 TO 1931

From "Southern California crops," annual statistical numbers, 1928 to 1932, inclusive. (Compiled by the Agricultural Department of the Los Angeles Chamber of Commerce from annual reports of the County Agricultural Commissioners, Federal Department of Agriculture carlot records, State Department of Agriculture acreage and price data, and books of various independent and cooperative commodity groups.)

A previous segregation of the southern California citrus areas by Vaile divided it into three main climatic zones—coastal, intermediate. and interior. It has been considered desirable in the present investigation to make a segregation which fully takes into account the local differences that should be recognized in a study of the value and cost of water. Needless to say, the farm advisers of the six southern coastal-

¹ See text, p. 22.

plain counties and the specialist in eitriculture of the Agricultural Extension Service were of great assistance in this connection.

Because of the importance attached by the writers to these local areas in the study with which this report deals, brief descriptive and informative statements regarding them have been placed in the appendix, pages 147 to 153. The total number of these areas as segregated is 15 for oranges and 7 for lemons. In most eases the areas embrace contiguous districts surrounding or including one or more cities, towns, or other population centers. In a few cases the districts embraced are not contiguous, although in the same general region and sufficiently homogeneous to justify their being placed together. The following summary lists the 15 orange and 7 lemon areas, shows the climatic zone within which each falls, and gives the population center or centers embraced or around which they are located. The frontispiece shows, by relief, the general topography of the southern California coastal plain, and gives the locations of the different areas studied.

LOCAL AREAS IN THE COASTAL PLAIN OF SOUTHERN CALIFORNIA COVERED IN THE STUDY OF THE VALUE AND COST OF WATER FOR IRRIGATION FOR CITRUS FRUITS

		Oranges
Area	Climatic zone	Districts included
1	Intermediate	Bostonia, El Cajon, Escondido, Vista, Fallbrook
2	Interior	Arlington, Riverside, Highgrove
$\frac{2}{3}$	Coastal	Tustin, Santa Ana, Orange
4	Intermediate	El Modena, Villa Park, Olive, Santa Ana Canyon, Yorba Linda
5	Coastal	Garden Grove, Anaheim
6	Coastal	Fullerton, Placentia
7	Interior	Redlands, Bryn Mawr, Crafton, Mentone, Highlands
8	Interior	East Highlands, Greenspot
9	Interior	Rialto, Bloomington, Fontana
10	Intermediate	Corona, Etiwanda, Alta Loma, Upland, Clare- mont, Ontario, Pomona, Cucamonga, Glendora, Azusa, Duarte, Monrovia
11	Intermediate	LaVerne, San Dimas, Charter Oak, Covina
12	('oastal	Whittier, La Habra, Rivera
13	Coastal	Hueneme, Ventura
14	Intermediate	Santa Paula, Santa Rosa Valley
15	Interior	Fillmore, Piru, Ojai Valley, Simi Valley
		Lemons
Area	Climatic zone	Districts included
1,-1	Coastal	Chula Vista, National City, Bonita
17-2	Intermediate	Bostonia, El Cajon, Escondido, Vista, Fall- brook
14-3	Coastal and	Whittier and the lemon districts of Orange

County

intermediate

Lemons—Continued

Area	Climatic zone	Districts included
1.4	Intermediate	Corona, Etiwanda. Alta Loma, Upland, Clare-
		mont, Ontario, Pomona, Cucamonga, Glendora, Azusa, Duarte, Monrovia
L-5	Intermediate	LaVerne, San Dimas, Charter Oak, Covina
L-6	Coastal	Hueneme, Ventura
17	Intermediate	Santa Paula

DATA RELATING TO COSTS OF PRODUCTION AND YIELDS OF CITRUS FRUITS¹

A total of 913 cost-of-production and yield records for citrus fruits have been used in the present study. Eight hundred thirty of these have been furnished by the California Citrus League and 83 by the Agricultural Extension Service of the University of California. The orange records, totaling 632, include 370 for Valencias and 262 for Navels. Lemon records total 247; grapefruit, 34.

With the exception of one 2-year record for grapefruit, all records used extended through at least 3 years. Sixty-seven per cent of the total were continuous for the years 1927–1931, 7 per cent for the years 1927–1930, and 9 per cent for the years 1928–1931, all inclusive.

Having been collected by different agencies and with different objectives, the records are not fully comparable as to all of the separate items. In spite of these differences, it has been possible to bring them together for purposes of tabulation and analysis without substantial error of statement. Where differences of consequence occur, attention is called to them.

As stated in the general discussion of costs of production in the previous chapter, the Citrus League cost-of-production records do not include depreciation of trees. To make them comparable with the Agricultural Extension Service records, the allowances for this item made in the latter have been added in all tables of costs given in this chapter beginning with Table 11. As used in the present study, however, the amount included for depreciation of trees has been recomputed to conform to a lower level of prices. Instead of depreciating both orange and lemon trees at the rate of \$31 per acre per annum, as was done by the Agricultural Extension Service in computing their cost-of-production records, the writers have depreciated oranges at the rate of \$20 and lemons at the rate of \$25 per acre. The computation leading to these figures appears in the appendix as Table E.

Another adjustment needed to permit grouping the two sets of records together has been to eliminate from the Agricultural Extension Service costs allowances for interest on investment, which were not included in the Citrus League records. It has been previously stated that in the present study this item is not considered as a cost.

While based largely on records of costs kept by the farmers, the "survey" method of gathering the data is used by the Citrus League. More than half of their cooperators use record books prepared by the League, and the cooperators are visited at the close of each season by

¹ For general discussion of the principles which have guided the use of the cost-of-production data, see Chapter I, p. 23.

a representative of the League. Actual expenditures are generally obtained from the records prepared by the growers for income tax returns. Labor performed by the cooperators or by members of their families is estimated. The principal uses for which the information is intended is in connection with tariff and freight rates, although many other uses are made of the statistics by the League. The plan under which records are kept by the Extension Service cooperators provides for daily entry of labor and material used, monthly summary under the direction of the county office of the Agricultural Extension Service, and annual summary by the county office of the Extension Service and the office of the extension specialist in charge in Berkeley. The purpose of their records is to increase farm efficiency by giving the individual cooperators a basis for studying their various farm operations more intensely, and for comparing the costs on their own farms with costs on the farms of other cooperators.

Because by far the larger number of records used in the study have come from the Citrus League, the cost data relating to citrus fruits presented in the following pages more nearly reflect the costaccounting procedure of that organization than that followed by the Agricultural Extension Service. However, except in one of the areas studied, in which the eosts in the Agricultural Extension Service records are generally lower than those shown by the Citrus League records, arrays of costs show those from the Agricultural Extension Service to be distributed fairly regularly throughout the range for all of the records in each area.2

In all statistical studies the value of the conclusion reached depends upon the degree to which the statistical material used is truly representative of the conditions to which it relates. In the present study much care was exercised to insure that the data used are representative.3 It was not possible to obtain random samples, since the cost-of-production records used were gathered prior to the beginning of the study, and, as already indicated, for other purposes. It therefore became necessary to see a large number of the groves to which the records obtained apply. In fact, approximately two-thirds of the citrus groves included in the study were visited, in many instances with the local farm adviser. By thus visiting every important citrus section in the southern California coastal plain, and considering the

¹ For more complete discussion, see Chapter I, p. 23.

² See tables A and B in the appendix.

³ There is no general agreement as to the meaning of the word "representative" when used in connection with a statistical sample. A definition frequently used by economists is that of Marshall (Marshall, Principles of Economics, 8th Edition, p. 317) in connection with describing a "representative firm." Such a one, according to Marshall, would not be "some new producer just struggling into position, who works under many disadvantages, and has to be content for a time with little or no profit, but who is satisfied with the fact that he is establishing a connection and taking first steps toward building up a successful business"; nor would it be one "who by especially long, sustained ability and good fortune has got together a vast business and huge and ordered workshops, that gives it a superiority over almost all of its rivals." Marshall's "representative firm" is "one which has had a fairly long life, and a fair success, which is managed with normal ability, and which has normal access to the economies, external and internal, which belong to that aggregate volume of production; * * *"

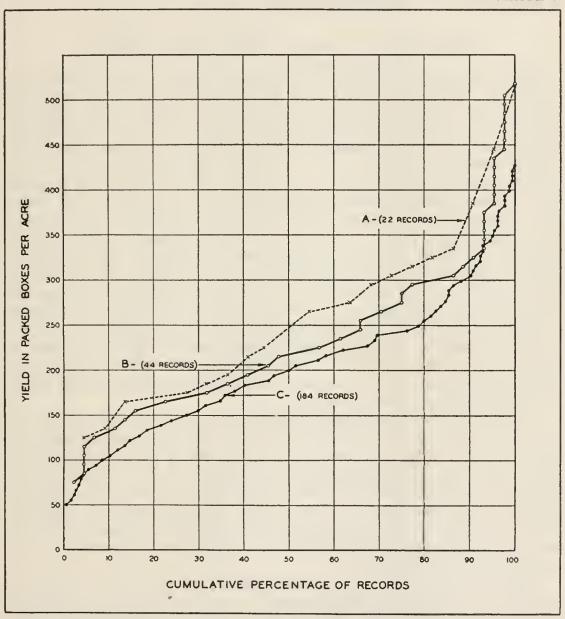
When the present investigation was begun, it was thought it could be contined to "representative" groves substantially as defined by Marshall, but it was found impractical to select the groves on that basis. The term "representative" as used in the present report is therefore intended to mean groves which are not exceptional relative to the other groves in the same area. Broadly, a grove poorer or better than 90 per cent of the other established and not neglected groves in the same area would not be considered representative of the area.

From the above it will be seen that the term "representative" as used in the present report covers a wider range than the "representative firm" of Marshall.

condition and the local cultural factors as they affect both individual groves and the area groupings made, it was possible to form a seasoned judgment as to the representativeness of the samples.

The conclusion has been reached that the records collected are fairly representative of the upper 80 per cent of established groves in all areas excepting number 8. In the latter the records are thought to cover the full range. Cumulative curves plotting the average yields

PLATE I



Cumulative percentage curves of yields of oranges as reported by 44 cost-of-production records from orange area 11, 22 similar records from the San Dimas-La Verne district in the same area and by 184 packing house records, also from area 11.

from one group of 22 groves and from another group of 44 groves, both in area 11, closely parallel a curve plotting the average of three years' yields from 184 groves in the same general area for which packing-house records are available (Plate I). The yields from the 22 groves are from about 20 to about 55 packed boxes per acre higher than the averages for the 184 packing-house records, and the yields from the 44 groves fall approximately midway between the yields for the

22 groves and the groves reported by the packing house. However, the packing-house records included all trees, while the others included none under nine years of age; also, the latter covered net acreages, while this was not entirely the case with the 184 groves reported by the packing house. A comparison of the average yields from the groves included in this study in each area with the average yields obtained from packing houses in such areas also shows higher yields for the records used in the study, but again the packing-house records include all bearing ages and are often for gross and not net acreages.

TABULATIONS OF COSTS, YIELDS, AND INCOMES

The cost-of-production data described above are presented in nine tables. The first three, Tables A, B, and C, give the average costs of production, yields, and when available, the returns to the growers. for each record obtained, the averages being for the three-to-six-year periods covered by the records. Returns to the growers have been available only in the case of the Agricultural Extension Service records, and appear only in Tables A and B. Because of their unusual length, these tables appear in the appendix. The other six tables which present the costs of production shown by the records used appear as tables 5 to 10. Table 5 gives the average annual cost of production and yield per acre for oranges in each of the areas studied. Table 6 presents the same material for lemons. Table 7 summarizes from Table C the data relating to grapefruit, showing averages for the records grouped together, rather than by separate areas. Tables 8 and 9 give the average amounts paid annually per aere by the growers for the various items of labor and material used in the production of oranges and lemons, as shown by the Citrus League records, and Table 10 presents the same data for oranges and lemons, as shown by the Agricultural Extension Service records.

In none of the tables listed above has any reduction been made in the production costs to conform to lower present and anticipated price levels for labor and materials, as has been done in all of the subsequent tables except number 16, relating to prices of citrus fruits. The purpose of the above tables is merely to present the data as gathered. The costs given are incomplete in that nothing is included for depreciation of trees. Furthermore, while the amounts paid for water are listed in all of the above tables, these amounts are not included in the totals given.

Attention is called to the small number of records obtained for grapefruit. That number is too small to warrant separate conclusions regarding costs and yields of this product, and the records presented can be given little weight except as confirming the general assumption that costs for grapefruit are comparable with those for oranges.

Finally, with reference to tables 5 to 10, it should again be noted that each record included is an average of from 3 to 6 one-year records, except in the case of two grapefruit records. Thus, the total number of complete one-year records represented in these nine tables is 4.254.

AVERAGE ANNUAL COSTS OF PRODUCTION AND YIELDS OF ORANGES, PER ACRE, BY SPECIFIED AREAS! TABLE 5

OUCTION AND YIELDS OF ORANGES,
Data summarized from Table A, appendix

Yield,	packed	200 201 201 200 200 200 200 200 200 200
100	water	880 880 880 880 880 880 880 880 880 880
	Depre- eiation ³	\$1222 11222 1176994332 117605 117605 117605 117605
	Insurance	\$1 181 182 1123 1125 1126 1145 1171 1171 1171
cre	Taxes	\$33 27 27 27 27 28 28 27 27 28 27 28 27 28 28 28 28 28 28 28 28 28 28 28 28 28
Average costs per acre	General	\$18 27 27 88 27 10 10 10 10 10 10 10 10 10 10 10 10 10
Aver	Labor	\$108 67 20 67 80 67 80 64 84 74 54 64 34 74 91 74 91 88 1 78 88 1 40 88 92 29 92 29 92 29 93 94 54 94 64 84 10
	Material	\$80 51 119 60 90 33 90 33 41 110 72 110 72 112 64 121 64 15 95 94 74 66 76
	Total ²	223 256 88 256 86 251 172 251 172 257 276 57 257 27 27 27 27 27 27 27 27 27 27 27 27 27
	rears of record	क्ष मां को मों मों मों मों मों मों मों मों क मां को को मों मों मों मों मों मों मों मों क मां को के कि टिंग्टिक के के टिंग्टि
	Average area, acres	28.28 28.00 20 20 20 20 20 20 20 20 20 20 20 20 2
	of records	12 24 25 25 25 25 25 25 25 25 25 25 25 25 25
	Area	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

¹ For description of areas, see appendix, p. 147.
² Does not include depreciation of trees or cost of water.
Does not include depreciation of trees.

AVERAGE ANNUAL COSTS OF PRODUCTION AND YIELDS OF LEMONS, PER ACRE, BY SPECIFIED AREAS TABLE 6

Data summarized from Table B, appendix

					Aver	Average costs per aere	ere				Yield.
Number of records	Acres	Years	Total:	Material	Labor	General	Taxes	Insurance	Depre-	Cost of water	packed
000000000000000000000000000000000000000	19.7 10.7 10.7 13.8 13.8 24.8 13.2 201.3	1-88995- 444444	\$203 77 210 94 222 90 264 21 271 84 279 67	\$77 39 71 74 86 50 122 27 106 90 57 57	\$84 98 103 39 86 14 86 51 93 83 118 15	\$15 32 12 73 12 62 16 59 22 90 56 73	\$22 86 12 97 12 97 26 05 26 22 23 60 21 30	\$60 49 1 16 2 2 18 4 18	\$2 71 8 71 10 10 11 11 27 22 43 51 51	\$37 18 23 93 22 21 49 82 43 74 25 31	177 170 170 238 163 163

For description of areas, see appendix, p. 152.

Does not include depreciation of trees or cost of water.

Does not include depreciation of trees.

AVERAGE ANNUAL COSTS OF PRODUCTION AND YIELDS OF GRAPEFRUIT, PER ACRE, AS SHOWN BY 34 SCATTERED RECORDS Data summarized from Table C, appendix TABLE 7

281 Yield, packed boxes 92 Cost of water \$37 88 Depre-ciation1 \$10 96 Insurance -<u>~</u> Taxes \$25 Average costs per acre \$25 01 General 9 Labor \$71 80 Material \$117 \$252 55 Totali - Years of record €1 ∞ Acres Number of records 34 Area Total or average.

¹ Does not include depreciation of trees or cost of water.
² Does not include depreciation of trees.

TABLE 8

AVERAGE AMOUNTS PAID ANNUALLY BY GROWERS, BY SPECIFIED AREAS, FOR THE VARIOUS ITEMS OF LABOR AND MATERIALS USED IN THE PRODUCTION OF ORANGES AS SHOWN BY 562 CALIFORNIA CITRUS LEAGUE RECORDS

	15(10)	\$50 98 11 553 11 253 1 253 6 35 0 0 65 96 6 31 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	\$158 33
	12(43)	\$55 239 82 239 889 239 889 11 12 24 12 25 12 26 13 26 14 13 16 14 15 15 16 16 16 16 16 16 17 16 16 17 16 16 18 16 16 16 16 16 16 16 16 16 16 16 16 16 1	\$181 58
	11(45)	\$711 30 17 87 17 87 17 87 7 04 1 11 1 11 1 19 1 19 1 19 1 19	\$210 45
	10(179)	\$78 116 52 117 444 174 444 174 6 52 174	\$200 52
	8(23)	\$8 88 88 88 88 62 62 63 63 64 64 64 64 64 64 64 64 64 64 64 64 64	\$187 94
11	7(88)	\$88 10 71 10 71 6 30 7 48 4 77 1 90 56 01 6 31 6 31 1 11	\$194 32
Arcal	6(31)	\$66 48 21 85 21 85 114 21 1 04 1 004 10 04 10 04 10 04 10 04 10 06 10 06	\$179 81
	5(23)	\$655 15 99 16 92 10 92 11 38 11 41 11 41 1	\$168 70
	4(22)	\$59 10 11 03 11 50 11 50 6 33 6 33 17 19 1 83 1 83 1 83 1 83 1 83 1 83 1 83 1 83	\$166 63
	3(51)	\$65 12 996 15 81 15 81 13 14 13 12 19 95 10 95 1	\$173 34
	2(35)	\$96 07 17 92 18 18 19 20 19 20 3 12 3 12 4 44 4 44 4 151 5 05 7 7 92 7 92 7 92 7 92 7 92 7 92 7 92 7	\$187 40
	1(12):	\$56 06 56 59 15 29 1 93 1 93 1 14 28 1 1 96 7 1 63 7 1 63 7 63 7 63 7 63 7 7 7 63 7 7 7 63 7 7 7 63 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	\$188 72
	Item	Fertilizer labor and material ial Spray material Frost protection material. Other material Other material Tractor expense Tractor hire Cultivation labor Frigation labor Frigation labor Frigation labor Frigation labor Frigation labor Free Gare Free Street	Totals

¹ For description of areas, see appendix, p. 147.
² Figures in parentheses indicate number of records represented.

TABLE 9

AVERAGE AMOUNTS PAID ANNUALLY BY GROWERS, BY SPECIFIED AREAS, FOR THE VARIOUS ITEMS OF LABOR AND MATERIALS USED IN THE PRODUCTION OF LEMONS AS SHOWN BY 236 CALIFORNIA CITRUS LEAGUE RECORDS

			Are	21		
Item	L-1 (19)3	L-2 (15)	L-3 (82)	L-4 (95)	L-5 (1S)	L-7 (7)
Fertilizer labor and material Fumigation material Frost protection material Other material Team expense Tractor expense Tractor hire Cultivation labor Pruning Tree care Frost protection labor Other labor Other labor	\$44 37 11 08 23 05 47 1 81 3 32 2 29 1 76 6 65 20 65 15 23 21 93 4 36 40 5 01	\$48 06 7 77 13 60 82 2 43 4 71 4 62 8 82 2 55 61 90 4 69 12 05 1 54 19	\$48 19 16 31 21 74 2 01 1 30 1 98 44 10 30 3 27 46 47 3 62 15 38 1 64 2 00 1 57	\$50 27 22 35 10 68 8 58 57 4 20 90 4 36 89 53 44 4 98 9 90 1 35 2 97 2 62	\$63 25 23 80 12 25 6 82 1 08 3 25 01 11 69 1 53 61 52 2 16 8 81 1 36 1 79	\$26 2. 11 73 9 83 11 44 7 6 55 3 6 23 0 0 53 44 10 11 22 8 8 5 1 7 16 7 16 3 83
Totals	\$ 162 37	\$175 15	\$176 22	\$208 05	\$200 73	\$175 7

For description of areas, see appendix p. 152.
 Figures in parentheses indicate number of records represented.

TABLE 10

AVERAGE AMOUNTS PAID ANNUALLY BY GROWERS, BY SPECIFIED AREAS, FOR THE VARIOUS ITEMS OF LABOR AND MATERIALS USED IN THE PRODUCTION OF ORANGES AND LEMONS AS SHOWN BY 81 AGRICULTURAL EXTENSION SERVICE RECORDS

			Ora	nges			Len	nons
Item			Ar	ea ¹			Aı	rea
	3 (16):	4 (2)	5 (31)	6 (10)	10 (7)	12 (6)	L-3 (9)	L-4 (3)
Irrigation— Preparation and application	\$ 16 31	\$ 13 72	\$13 37	\$17 S6	\$14-42	\$ 13 95	\$12 S7	\$15 06
Fertilizer— Material and application Cover erop labor and seed	69 34 2 13	61 66 2 12	60 0S 1 94	77 98 1 82	92 26 34	39 59 1 98	48 00 1 56	133 31 0
Labor— Funnigation. Spray Disease control. Parasite control.	6 11 6 32 2 61 02	1 67 7 50 5 91	6 54 6 79 2 97	S 95 6 73 2 18	65 7 58 81 24	7 16 9 86 1 39 01	5 64 9 15 1 80	10 27 1 21 33 0
Rodent control	0 2 81 39 6 74	0 0 0 16 S1	01 36 01 27	06 10 08 7 98	0 8 84 72 15 44	0 02 0 13 16	01 1 22 08 11 65	0 7 5 6 20 7
Cultivation. Miseellaneous. Material—	18 \$8 \$4	20 19 51	1 98 73	16 42 1 14	15 S1 1 78	22 35 1 93	23 10 1 68	17 60 2 7
Fumigation Miscellaneous Spray Disease control	6 45 15 7 32 51	2 45 0 11 39 0	\$9 96 7 98 20	S 41 98 11 02 56	1 24 2 84 9 88 0	6 32 1 36 12 81 19	5 49 2 08 11 21 11	13 17 75 3 75 0
Parasite eontrol	17 0 1 50	0S 0 0	03	02 02 22	0 61 7 13	0 0	89	0 0 5 0
Totals	\$148 60	\$144 07	\$132 22	\$162 60	\$180 62	\$132 OS	\$ 136 55	\$232 17

This item sometimes includes costs for operations, such as for furrowing out, or miscellaneous team or tractor work not normally entered under this heading.

For description of areas, see appendix pp. 147-153.
 Figures in parentheses indicate number of records represented.

Reference to Table 5 discloses the fact that no cost-of-production records for oranges are included for orange area 13—plains land west and south of Saticoy, Ventura County—or area 14—Santa Clara River Valley between Saticoy and the mouth of Sulphur Canyon, also Santa Rosa Valley. Ventura County—and only 10 for orange area 15—the Fillmore-Piru section of Santa Clara River Valley and Ojai and Simi valleys. Furthermore, it will be seen from Table 6 that no cost-of-production records are included for temons for area L-6—the plains land west and south of Saticoy, Ventura County—and only 7 records for area L-7—Santa Clara River Valley between Saticoy and the mouth of Sulphur Canyon, also Santa Rosa Valley, Ventura County. Realizing the inadequacy of the available data for Ventura County, information regarding yields and returns to the growers was obtained, with the assistance of the county farm adviser, from the managers of the principal Ventura County packing houses. The records all apply to mature groves and were selected by the farm adviser, the packing house managers, and a representative of the Division of Irrigation Investigations and Practice, with a view to presenting cross sections of the Ventura County orange and lemon industry. This information is presented as tables A-1, B-1 in the appendix. The information in these tables is summarized below. The periods covered by the records in each case include the season ending October 31, 1932. Excepting for one 4-year record for lemons and ten 2-year records for oranges, the records of yields and returns to the growers extend back from 5 to 7 years from 1932. Yields given represent packed-box equivalents for fruit delivered to the packing houses rather than the actual packed boxes sold for the account of each grower.

Table A-1, oranges.—Seven 5-year orange records for area 13, representing an average area of 15.5 acres each, show average yields in packed boxes per acre ranging from 101 to 483, and averaging 246. Average returns to the growers, with picking and hauling costs not deducted, ranged from \$256.42 to \$1,349.67, and averaged \$698.27.

Fifteen 5-year orange records from area 14, representing an average area of 18 acres for each grove, showed yields in packed boxes per acre ranging from 122 to 460, and averaging 260. Average returns to the growers, picking and hauling costs not deducted, ranged from \$318.59 to \$1,408.53, and averaged \$775.75.

Forty-seven orange records from area 15, covering an average of 5.7 years each, and representing an average area of 13.5 acres, show average yields in packed boxes per acre ranging from 77 to 472, averaging 219. Returns to the growers, with picking and hauling costs not deducted, ranged from \$249.53 to \$1,135.81. averaging \$467.57.

Table B-1, lemons.—Twenty-eight lemon records from area L-6, covering an average of 6 years each and representing an average area of 14 acres each, show average yields in packed boxes per aere ranging from 68 to 364, averaging 226. Returns to the growers, without deduction for picking and hauling costs, ranged from \$203.03 to \$1,349.07, and averaged \$793.68. The percentage of fruit sent to by-products by the packing houses was 12.38.

Twelve 7-year lemon records for area L-7, representing an average area of 17.5 acres each, showed average yields ranging from 112 to 306 packed boxes per acre, averaging 223. Average returns to growers, without deduction for picking and hauling eosts, ranged from \$323.24 to \$953.83, and averaged \$632.59. Fruit sent to by-products amounted to 12.74 per cent of that received from the growers.

RESIDUAL INCOME FROM CITRUS PRODUCTION ABOVE OTHER COSTS THAN THE COST OF WATER

As previously explained, the data relating to the cost of producing citrus fruits in the coastal plain of southern California that have been presented or referred to above show the amounts growers paid for labor, materials, and general expenses during a period of higher prices than now prevail, or than can be assumed in the present study. It was stated that it had been decided to make certain reductions in the unit costs of labor and material, and in taxes, prior to using the data as a basis for studying the value and cost of water.²

It has been thought best to set up the revised costs in frequency tables3 which will show for oranges, lemons, and grapefruit separately how these costs vary. This is done in frequency tables 11, 12, and 13. In these tables only total costs of production are included, and as in the case of tables A, B, and C, and tables 5 to 10, no allowance is made for the cost of water. The totals on which tables 11, 12, and 13 are based are not strictly comparable with the totals in tables A, B, and

¹ Chapter I, p. 25. ² Materials used most widely in the production of citrus crops are fertilizer, organic and inorganic, cyanide for fumigation, spray materials, and fuel for both organic frost protection.

More money is spent for fertilizer than for any of the other materials. Keen competition has existed between dealers in the two classes of fertilizer, causing drastic reduction in prices since 1929. The price to the farmer for ammonium sulphate has fallen over 50 per cent during the period 1929 to 1932.

It is anticipated that when surplus supplies of organic fertilizers have been utilized, there will be a rise from the low prices of 1932. The writers have, therefore, assumed a reduction of 30 per cent over prices paid during the period the cost records were secured.

Funigating is done mainly by large contracting companies. Reduction in prices for cyanide has not been comparable with the fall in other materials. The increased competition from spraying, which can be done by the individual growers, combined with a general fall in commodity prices, will, it is assumed, cause a further reduction in the price of this product. The writers have reduced the costs for pest control shown in the records by 20 per cent.

With these reductions in the cost of material, a weighted average of 24.7 per cent was secured. For the purposes of this report, 25 per cent has been adopted for the reduction to be applied to the total cost of materials reported in the cost-of-production records.

records.

Prices allowed for labor by the collectors of the cost data have been available. These ranged from 60 cents an hour for pruning and tractor operation to 45 cents for miscellaneous labor. A census of the prices paid for labor in the citrus areas shows that the reductions were not significant until the end of the 1931 season. Since that time there has been a greater reduction. It is assumed that prices will stabilize around 40 cents an hour for such operations as pruning, spraying, tractor operation, and frost protection, and around 30 cents an hour for irrigation and miscellaneous labor. Substituting these prices for those used in the cost-of-production studies, the total cost of labor was lowered 24.8 per cent. The writers have used 25 per cent.

studies, the total cost of labor was lowered 24.8 per cent. The writers have used 25 per cent.

It is of course to be recognized that, especially under present uncertainties regarding prices and in view of the various measures that are being taken or proposed looking toward inflation, estimates of future prices of labor and materials are difficult to make. However, the writers have endeavored to make the figures used reflect the judgment of those having a practical knowledge of orchard production.

3 A frequency table, as will be clear from those given in this report, is one in which values are set up in groups, or "class intervals" of some given range, as 100 to 110 boxes, or \$10 to \$20, and the number of times individual values fall within each group or "class interval" is shown. In the frequency tables of this report, the range or "class interval" is indicated in the left-hand column, and the number of times costs, yields, or incomes fall within each range or "class interval" is given in the succeeding column or columns.

C, since the item of depreciation in the latter does not include depreciation of trees, which is included in the total costs used in making up tables 11, 12, and 13. Because variations in yield are equally significant with variations in costs, frequency distributions have also been made to show them, these appearing in Table 13 for grapefruit and in tables 14 and 15 for oranges and lemons.

It will be noticed that, with a few exceptions, these frequency tables fail to bring out either costs or yields in the individual areas which can be considered satisfactorily representative of the area as a whole. If the range (class interval) were to be twice or three times that used (\$10 in the case of costs and 10 boxes in the case of yields) enough groves would fall within each range to indicate "most representative" costs and yields, but the value of such statistical treatment in these cases seems questionable. The tables are included rather because they show most clearly the way in which costs and yields vary within the areas.

TABLE 11

FREQUENCY DISTRIBUTION OF ANNUAL COSTS OF PRODUCING ORANGES, IN-CLUDING DEPRECIATION ON EQUIPMENT AND TREES BUT NOT INCLUDING COSTS OF HARVESTING, PACKING, MARKETING, OR FOR WATER, ADJUSTED TO ASSUMED LOWER PRICE LEVELS FOR LABOR AND MATERIALS AND ASSUMED LOWER TAXES. FIGURES IN AREA COLUMNS INDICATE NUMBER OF FARMS IN EACH COST GROUP

Range in costs,							Area1						
dollars per acre²	1	2	3	4	5	6	7	8	10	11	12	15	Total
90-100 100-110 110-120 120-130 130-140 140-150 150-160 160-170 170-180 180-190 190-200 200-210 210-220 220-230 230-240 240-250 250-260 260-270 270-280 280-290 290-300 300-310 310-320 320-330 Over 330	1 1 1 2 1 1 3	3 2 5 2 3 3 5 2 1 1 1 2 1	2 1 1 2 5 8 6 4 5 6 6 6 7 2 4	4 2 2 2 2 2 1	1 4 5 5 5 4 1 6 6 6 5 4 4 4 3 1 1 1 2 1	1 4 1 5 6 2 2 2 5 5 4 1 1 1	1 3 4 3 6 6 6 2 7 4 5 7 13 6 4 10 1	1 2 3 1 1 3 5 2 3	5 2 6 7 10 18 21 11 11 19 16 12 17 16 14 11 3 3	2 3 2 7 4 11 4 1	1 1 1 2 3 10 4 3 4 1 1 1 3 2	2	16 66 9 18 27 25 45 53 45 50 49 49 34 25 77 52 10 32 22
Totals	12	35	67	24	54	41	88	23	185	44	49	10	632

¹ For description of areas, see appendix, p. 147.

* Lower limit inclusive.

TABLE 12

FREQUENCY DISTRIBUTION OF ANNUAL COSTS OF PRODUCING LEMONS, INCLUDING DEPRECIATION ON EQUIPMENT AND TREES BUT NOT INCLUDING COSTS OF HARVESTING, PACKING, MARKETING, OR FOR WATER, ADJUSTED TO ASSUMED LOWER PRICE LEVELS FOR LABOR AND MATERIALS AND ASSUMED LOWER TAXES. FIGURES IN AREA COLUMNS INDICATE NUMBER OF FARMS IN EACH COST GROUP

Range in costs,			Ar	eaı			
dollars per acre²	L-1	L-2	L-3	L-4	L-5	L-7	Total
100-110	2 2 2 2 3 3 3	1 1 1 3 1 2 1 1 1	2 2 2 6 4 6 4 4 5 6 6 6 2 4 7 6 1 7 6 1 7 1 3 2 4 2 1 1 3 2 4 2 1 1 3 2 4 2 1 3 2 4 2 4 2 4 2 4 2 4 2 4 2 4 2 4 2 4 2	1 1 1 1 2 2 2 5 9 6 11 8 4 10 5 3 3 1 7 6 6 6 7	1 1 1 2 3 2 1 1 1	1 1 2	
Totals	19	15	90	98	18	7	2.

¹ For description of areas, see appendix, p. 152.

² Lower limit inclusive.

TABLE 13

FREQUENCY DISTRIBUTION OF ANNUAL COSTS OF PRODUCTION AND YIELDS OF GRAPEFRUIT

Costs include depreciation of equipment and trees, but do not include cost of harvesting, packing, marketing, or water, and are adjusted to assumed lower price levels for labor and material and assumed lower taxes

Range in eosts, dolla per acre		Range in yields, packed boxes per acre ¹	Number of farms	
120-I30 130-140		120-I30 130-I40	1	
140-150		140-150	1	
150-160		150-160		
160-170		160-170	1	
170-180	2	170-180	1	
180-190		180-190	4	
190-200		190-200	1	
200-210	4	200-210		
210-220	8	210-220	2	
220-230		220-230		
. 230-240		230-240	1	
240-250	$\frac{1}{2}$	240-250	2	
250-260		250-260		
260-270		$\begin{bmatrix} 260-270 \\ 270-280 \end{bmatrix}$	ns we	
270-280		280-280		
280-290 290-300		290-300	ī	
300-310	.	300-310	3	
310-320		310-320	4	
310-320	,	320-330	*	
		330-340	Ĩ	
		340-350	$\overline{2}$	
		350-360	3	
		360-370		
		370-380		
		380-390		
		390-400		
		400-410	1	
		410-420	1	
		420-430	1	
		430-440	- -	
		440-450	1	
		450-460 460-470	1	
		470-480		
		480-490		
		490-500	1	
		130 000	_	
Totals	34		34	
	1	II .	1	

¹ Lower limit inclusive.

TABLE 14 FREQUENCY DISTRIBUTION OF YIELDS OF ORANGES, BY SPECIFIED AREAS Figures in area columns indicate number of farms in each yield group

Range in yields,						Are	eat						
packed boxes per acre ²	1	2	3	4	5	6	7	8	10	11	12	15	Total
20- 30. 30- 40. 40- 50. 50- 60. 60- 70. 70- 80. 80- 90. 90-100. 100-110. 110-120. 120-130. 130-140. 140-150. 150-160. 160-170. 170-180. 180-190. 190-200. 200-210. 210-220. 220-230. 230-240. 240-250. 250-260. 260-270. 270-280. 280-290. 290-300. 300-310. 310-320. 330-340. 340-350. 350-360. 360-370. 370-380. 380-390. 390-400. 400-410. Over 410.	1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 2 2 2 2 3 3 3 1 2 2 2 2 3 3 3 1 2 2 2 2	2 1 1 3 2 1 2 5 5 9 2 3 3 2 1 1 1 1 1 1	1 2 2 3 1 2 4 4 2 4 1 1 2 2 1 1 1 2 2 4 1 1 2 2 4 1 1 1 2 2 4 1 1 1 1	1 2 2 4 5 6 6 4 3 5 5 3 4 4 3 3 5 5 3 4 4 5 6 6 4 5 6 6 6 6 6 6 6 6 6 6 6 6 6	1 3 3 1 1 3 4 4 3 5 5 1 2 2 1 1 1 2 2 1 1 1 2 2 4 1 1	1 2 2 2 3 4 7 7 2 9 9 2 4 4 8 8 3 1 2 2 2 2 1 1 1 1 1 1 2 2 2 1 1 1 1 1	1 1 1 2 2 2 1 1 1 3 3 3 1 1 1 1 1 1 1 1	3 3 2 3 5 5 7 3 8 9 10 13 7 7 12 18 10 12 6 8 6 4 4 4 4 5 5 2 4 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1 1 2 1 3 4 2 2 2 2 1 1 4 2 2 2 2 1 1 1 1 1 1 1 1	1 1 2 1 3 3 6 4 4 1 1 5 3 3 1 1 1 1	1 1 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1 1 3 5 5 7 6 6 12 15 16 20 16 6 20 16 37 7 34 42 43 32 28 19 29 26 18 11 16 8 11 15 5 5 2 2 2 2 3 3 1 6 6 6 32
Totals	12	35	67	24	54	41	88	23	150	44	49	10	002

¹ For description of areas, see appendix, p. 147. ² Lower limit inclusive.

TABLE 15

FREQUENCY DISTRIBUTION OF YIELDS OF LEMONS, BY SPECIFIED AREAS Figures in area columns indicate number of farms in each yield group

Range in yields,			Ar	ea.			
packed boxes per acre?	L-1	L-2	13	14	L-5	L-7	Total
40-50 50-60 60-70 70-80 80-90 90-100 100-110 110-120 120-130 130-140 140-150 150-160 160-170 170-180 180-190 190-200 200-210 210-220 220-230 230-240 240-250 250-260 260-270 270-280 280-290 300-310 310-320 330-340 340-350 350-360 360-370 370-380 380-390 390-400	1 4 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1 2 3 2 2 1 1 1 1	1 2 2 6 3 11 3 7 5 7 5 5 5 2 7 4 4 3 5	1 1 1 3 4 4 4 3 3 6 3 6 4 4 4 4 4 2 3 3 7 6 6 4 2 3 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 2 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Over 400	19	15	90	98	18	7	247

¹ For description of areas, see appendix, p. 152.

If it may be assumed that the adjusted costs on which tables 11, 12, and 13 have been based correctly represent what growers may anticipate as necessary, these costs, together with the yields given in tables A, B, and C in the appendix and summarized in tables 5, 6, and 7 in the text, furnish a basis for estimating for citrus fruits the probable residual income above costs other than the cost of water. To do this, however, it is necessary to use either some single price to be received by the growers for their products, or some appropriate range of prices. As between a single price and a range of prices, the latter is considered preferable. It would seem that such a range of prices should extend above and below the price which will just cover the costs of production. The ranges decided on for the discussions to follow are from \$1.50 to \$3 per packed box for oranges and from

² Lower limit inclusive.

¹While it has been found desirable to make the reductions in costs of labor and materials mentioned on page 26, it is assumed that the yields shown by the records can be considered reasonable expectations for the future, since they represent averages for 3 to 6 years during a normal period of production. However, these yields are not necessarily the same as the packed boxes sold by the exchanges, because large quantities of oranges have been marketed loose, and substantial percentages of lemons are annually sent to the by-products plant of the California Fruit Growers' Exchange.

\$2 to \$4 per packed box for lemons, these prices being f.o.b. shipping

While prices secured by the individual growers in any one season sometimes vary widely, owing to quality of product and time of marketing, and while annual f.o.b. average prices are likely at times to be lower or higher than the limits of the ranges decided on, the latter are thought to be sufficiently wide for analyzing the problem under study. In fact, as will appear later, the final analyses on which the principal conclusions regarding the value and cost of water for citrus fruits are reached proceed from still narrower ranges. The average f.o.b. price for citrus fruits received by California growers during the years for which records were available is given in Table 16, this having come from the California Fruit Growers' Exchange through Dr. H. R. Wellman, of the University of California. Differences in prices received as small as 10 to 20 cents a packed box are significant, because to the growers of average yield, 10 to 20 cents a packed box will cover the cost of water in most of the citrus areas of southern California.

TABLE 16

AVERAGE F.O.B. PRICES PER PACKED BOX RECEIVED BY THE CALIFORNIA FRUIT
GROWERS' EXCHANGE FOR FRUIT SHIPPED DURING THE SEASON

Season	Navel oranges	Valencia oranges	Lemons	
1904-05	\$1 14	\$2 80	\$2 14	
1905-06	1 83	3 26	2 91	
1906-07	1 66	3 08	3 21	
1907-08	1 60	2 74	2 02	
1908-09	1 46	1 85	2 08	
1909-10	1 56	2 33	3 41	
1910-11	1 51	2 50	3 01	
1911-12	1 48	2 34	2 86	
1912-13	1 94	2 74	4 99	
1913-14	1 35	1 86	3 62	
1914-15	1 37	2 33	1 60	
1915-16	1 66	2 85	3 11	
1916-17	1 74	2 58	3 06	
1917-18	3 82	3 92	5 12	
1918-19	3 58	3 93	3 64	
1919-20	3 90	4 00	3 06	
1920-21	2 48	3 35	4 00	
1921-22	3 91	4 64	4 05	
1922-23	$\begin{bmatrix} 2 & 70 \\ 2 & 12 \end{bmatrix}$	$\begin{array}{c c} 2 & 78 \\ 3 & 24 \end{array}$	4 83 2 59	
1923-24	2 12	3 24	2 99	
1924-25	3 68	5 15	4 55	
1925-26	3 56	3 56	3 27	
1926-27	3 50	4 09	4 05	
1927-28	4 37	5 69	4 84	
1928 -29	2 74	2 77	4 66	
1929-30	4 44	5 70	5 16	
1930-31	2 29 1 92	2 39 1 93	4 13 3 75	

¹ The average prices received by the growers are of course less than the average f.o.b. prices shown in the table, since the local exchanges deduct the cost of packing and marketing.

It is already clear from the tables which have been presented, particularly tables 11 to 15, that there must be a wide variation in the income to growers of citrus fruits. How wide this variation is and the manner in which it occurs is most strikingly brought out when the data are arranged in the form of frequency distributions. These



exclusive				Area 1								Area 2								Area	3							A	irea 4							Area	5							Area	6				
ester and erest on estment ²	\$1.50	\$1.75	\$2.00	\$2.25	\$2.50	\$2.75	\$3.00	\$1.56	0 \$	1.75	\$2.00	\$2.25	\$2.50	\$2.	5 \$3.0	0 8	1.50	\$1.75	\$2.0	\$2.2	25 \$	2.50	\$2.75	\$3.00	\$1.50	\$1.7	5 \$2	2,00	\$2.25	\$2.50	\$2.75	\$3.00	\$1.50	\$1.75	\$2.00	\$2.2	\$2.	50 \$2	1.75 \$3	.00	\$1.50	\$1.75	\$2.0	\$2.25	5 \$2	.50 \$2	2.75	\$3.00	1
0 to -\$240									1] _																																1
to - 220 .								-																																									4
to — 200																																																	1
to — 160 to — 140								-	2	1	•						1																								1								4
to - 120	1 .								2								2 -					-			3								3		2-						1								-
to - 100 to - 80	3								6	6							5	i							3		1	;-					å		-	1	- ; -				4	5							
to — 60 to — 40	3	1 3							5	2	2 4	3					15	4		2					2		2			1			10		5	1	1				8	1 7		3					ı
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After deducting all costs to grower for harvesting and packing, and after reducing costs of production to assumed price levels. (See page 26.)

TABLE 17
INCREMENTS OF 75 CENTS FROM \$1.50 TO \$3.00 PER PACKED BOX ARE APPLIED TO THE AVERAGE YIELDS OF EACH GROWER

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have therefore been set up for oranges in Table 17. This table shows the number of growers whose income above other costs than the cost of water falls within each succeeding \$20 group or "class interval" with f.o.b. prices of \$1.50 to \$3 per packed box.

As an example of how Table 17 brings out the variations in income, reference is made to area 10 in the table. This area is selected because more records have been obtained from it than from any other area, and because it shows the widest ranges.

The left-hand column of Table 17 gives the ranges in income above other costs than the cost of water, as 0 to \$20, \$20 to \$40, \$40 to \$60, and so forth. The seven columns relating to area 10 show for the different prices the number of growers whose income above other, costs than the cost of water falls within each of the ranges or 'class intervals' given in the first column.

For instance, it is found that 13 growers received an income above other costs than the cost of water ranging from 0 to \$20 per acre with an f.o.b. price for oranges of \$1.50 per packed box. The number falling within this same range of 0 to \$20 is 18 at \$1.75 per packed box, 14 at \$2, 8 at \$2.25, 4 at \$2.50, 3 at \$2.75, and 3 at \$3.

If it is desired to follow through the way the 185 growers are distributed among the different income groups at any given f.o.b. price, the procedure may be illustrated by reference to the columns in area 10 relating to an f.o.b. price of \$2.25.

It will be noted that one grower in area 10 shows a loss of somewhere between \$200 and \$220 per acre after paying all costs other than the cost of water. At the other extreme one grower had an income above costs other than the cost of water between \$560 and \$580. The largest number of growers received income above other costs than the cost of water ranging from \$20 to \$180. If one adds up the figures in the \$2.25 column above the heavy horizontal line directly above 0 to \$20, it will be found that 25 out of the 185 growers show a loss. The range in loss for 22 of these 25 growers, however, is only from 0 to \$120.

Other interesting facts are brought out by the figures in the same column falling below the heavy horizontal line.

For instance, of the 160 growers who show some profits above other costs than the cost of water, 127 show a residual above other costs than the cost of water ranging between 0 and \$180 and 33 show a residual ranging between \$180 and \$580. The largest number falling within any one \$20 range of income above other costs than the cost of water is 22.

Table 17 also shows that in each area the range in variation in residual income over other costs than water increases as the f.o.b. price increases. For instance, referring again to area 10, with an f.o.b. price of \$1.50, the range is from minus \$240 to plus \$220—an extreme range of \$460. If the f.o.b. price is \$3, the range is from minus \$180 to plus \$680—a total of \$860.

While Table 17 well brings out important characteristics of the data presented, it is not possible to select from this table single figures relating to residual income above costs that can be considered representative of all of the growers. For instance, in the column in area 10 giving the frequency distribution of the growers with an f.o.b. price

of \$1.50 per packed box, the largest number are in the group or "class interval' representing a loss of \$80 to \$100 per acre. However, there are nearly as many growers in four other groups, namely, in those showing losses of \$100 to \$120, \$60 to \$80, \$40 to \$60, and \$20 to \$40. A similar situation is shown in the columns relating to f.o.b. prices of \$1,75, \$2, and \$2.25, although in the latter columns the number in the largest group is relatively greater than in the adjacent groups. Area 10 comes nearer to showing a satisfactory "modal" or "most representative" figure than either of the others, but it is seen that even in this area, no one range in costs above income can be picked out for any f.o.b. price which can be satisfactorily used as a basis for determining the value and cost of water for irrigation. The frequency distributions in Table 17 do, however, bring out very clearly not only the extent but also the nature of the variations in income obtained in eitrus production in response to different costs and yields and different prices received for the products grown.

In the discussion in Chapter I under the heading "Summarization of Statistical Data" the conclusion was reached that in the present study of the value and cost of water for irrigation it has seemed desirable to consider (1) the average residual income above other costs than the cost of water obtained by the middle half of the growers in each area and (2) the residual income above costs received by the growers with least income in the upper two-thirds group in each area.

In accordance with the procedure that has been outlined, tables 18 and 19 have been prepared. Table 18, which relates to oranges, shows the residual income above other costs than water to the "average" grower and the lowest residual income above costs in the upper two-thirds group with f.o.b. prices ranging in increments of 25 cents from \$1.50 to \$3 per packed box. Table 19 presents similar information for lemons, except that the range in f.o.b. prices is from \$2 to \$4 per packed box. In the case of both these tables allowance has been made for depreciation of trees.

The following comments in regard to these two tables seem pertinent:

Table 18: Under the assumptions made as to costs and yields, in only five areas out of the 12 included in the table will the average residual income obtained by the middle half of the growers exceed costs, not including water, with an f.o.b. price of \$1.75 per packed box, and in only two areas will the amount of that residual income above costs at that price approximate the present cost of water in such areas. In no area, with the same f.o.b. price, will the least income in the upper two-thirds group cover costs, even without any allowance for water, and in five of the areas the deficit exceeds \$40 per acre. With an f.o.b. price of \$2, the average grower in the middle half could pay present water charges in all areas except one, and in most of the areas there would still be an amount left over to pay interest, although not sufficient to pay interest on what are generally considered normal land valuations. With an f.o.h. price of \$2 one area shows a deficit when the lowest residual income above costs in the upper two-thirds group is considered. In one the residual income is just sufficient to cover all costs other than water. In four it is sufficient to cover present, average water costs. With the costs and yields assumed, an f.o.b, price

TABLE 18

COMPUTED ANNUAL INCOME PER ACRE FROM ORANGES, AFTER ALLOWING FOR DEPRECIATION AND PAYING ALL COSTS OF PRODUCTION, HARVESTING, AND PACKING, EXCEPT THE COST OF WATER, WITH F.O.B. PRICES OF \$1.50 TO \$3.00 PER PACKED BOX

Columns headed "A" are for the average of the middle half of the growers; columns headed "B" are for growers receiving the least income above costs in the upper two-thirds group of growers,² Data from 632 California Citrus League and 72 Agricultural Extension Service records

	\$3.00	~		\$213 264 264 257 270 270 231 234 234 299 342 256 197 198 198
			4	
	5	2	8	\$165 151 173 173 193 193 1149 1149 1149 1148 66
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	ıç.		В	\$68 544 544 772 779 779 779 779 779 779 779 779 779
	\$2.25		A.	\$92 98 105 117 117 1125 183 183 94 94 94 95 87
	00		æ	\$20 133 339 339 60 7 7 7
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in the appear and			Area	1 (12) ³ 2 (35) 3 (67) 4 (21) 5 (34) 6 (41) 6 (41) 10 (185) 11 (44) 12 (49) 12 (49)

Costs adjusted to reduced price levels. (See text, p. 25.) For discussion of the "average" and "two-thirds" groups, see text, p. 27. Figures in parentheses indicate number of records.

TABLE 19

COMPUTED ANNUAL INCOME PER ACRE FROM LEMONS, AFTER ALLOWING FOR DEPRECIATION AND PAYING ALL COSTS OF PRODUCTION, HARVESTING, AND PACKING, EXCEPT THE COST OF WATER, WITH F.O.B. PRICES OF \$2 TO \$4 PER PACKED BOX! Columns headed "A" are for the average of the middle half of the growers; columns headed "B" are for growers receiving the least income above costs in the upper two-thirds group of growers.² Data from 247 California Citrus League and 11 Agricultural Extension Service records

A B	
\$26 -21 -21 -40 -50 -63 -24 -21 -43 -50 -63	

Oosts adjusted to reduced price levels. (See text, p. 25.) For discussion of the "average" and "two-thirds" groups, see text, p. 27. Figures in parentheses indicate number of records.

of \$2.25 per packed box would be needed to make the industry fairly compensatory to the average grower, and that price would, in several of the areas, leave the lowest grower in the upper two-thirds group in, or very close to, the marginal class. In connection with these statements it should be recalled that the costs taken into account in the present report include all materials, all labor hired, payment to the farmer for his own labor, depreciation on trees at the rate of \$20 per acre, and usual overhead such as insurance, taxes, and general expenses.¹

Table 19: With f.o.b. prices for lemons up to \$2.25 per packed hox, none of the areas shows a residual income sufficient to meet costs, with deficits in some cases exceeding the allowances for noneash costs included, such as depreciation and allowance for labor performed by the farm owner. With an f.o.b. price of \$2.50 per packed box, only one of the growers has a residual above costs approximately sufficient to cover the present average water costs, with nothing for interest. At this f.o.b. price only one area in the "B" column shows a residual above costs. Even at \$2.75 per packed box there would in some cases be deficits both in the case of the average of the middle half of the growers and the growers with least income in the upper two-thirds group. At \$3 per packed box most of the areas, under both the "average" and the "two-thirds" groupings, show residual income sufficient to, meet the usual charges for water and leave something for interest, but it is not until an f.o.b. price of \$3.25 is reached that all of the areas show a residual income above other costs than water and a return above costs in most of the areas which approximates what might be considered the minimum expectation.

AVOCADOS

Although there are a few scattered plantings of avocados in northern and central California, the commercial aereage of the State is almost wholly in the six southern coastal counties, together with Santa Barbara County. Only in San Diego, Los Angeles, and Orange counties is the acreage yet large enough to be important, and even in these counties the plantings are mostly recent. In fact, the opening of new lands in San Diego County, largely following completion of Henshaw Reservoir about ten years ago, has given the main impetus to the expansion of the industry, although it has been locally important in parts of Los Angeles and Orange counties, and has been looked upon as a commercial industry, for more than 20 years.

The present acreages of avocados and their distribution in the seven southern coastal counties are shown in Table 20. It will be noticed that the bearing acreage in 1932 was about six times that of 1927, and that the nonbearing acreage in 1932 was one and a half times

the bearing acreage in that year.

The avocado is a subtropical fruit and its commercial culture is therefore limited to localities with relatively mild winters. Hodgson states that on the basis of varieties now grown, commercial culture of the avocado is destined to be fully as restricted as the lemon, if not

¹ For full discussion of costs as defined in the present report, see Chapter I, p. 23.

more so. Present plantings are largely in the areas in which lemons are prominent, particularly those subject to the coastal influence, such as around Mt. Helix, La Mesa, Rancho Santa Fe, San Dieguito, Eneinitas, and Vista, in San Diego County, La Habra and Whittier, in Orange and Los Angeles counties, and near Ventura in Ventura County. Commercial plantings are found on a wide range of soils. Irrigation requirements, so far as known, seem approximately the same as for citrus fruits, and equal, if not a little more, attention needs to be given to protection from frost and wind.

TABLE 20 ESTIMATED ACREAGE OF AVOCADOS IN SEVEN SOUTHERN COASTAL PLAIN COUNTIES OF CALIFORNIA:

			Bear	ing			Non-
County	1927	1928	1929	1930	1931	1932	bearing 1932:
Santa Barbara Ventura	20	20 22	36 31	36 40	76 47	134	72 99
Los Angeles Orange San Bernardino	374 59	582 210	753 310 38	893 321 44	1,097 367 44	1,282 448 65	926 823 35
Riverside San Diego	11 219	16 318	20 675	$\frac{20}{975}$	20 2,165	20 2,184	35 4,729

From "Aereage estimates, California fruit and nut crops, 1927 to 1932," issued by the California Cooperative Crop Reporting Service, Special Publication 117.

Does not include plantings made in 1932.

Avocados have been given consideration in the present report because in certain sections, chiefly in Vista and San Dieguito irrigation districts, in San Diego County, the avocado acreage exceeds that of other orehard plantings. In such areas the cost and value of water will be largely influenced by its cost and value for avocados. However, being a comparatively recent industry, available records of costs of production and yields are limited, and are chiefly confined to those gathered in Orange County by the Agricultural Extension Service during 1930, 1931, and 1932 in connection with their enterprise Data pertinent to the present study are summarefficiency studies. ized or computed from these records in Table 21. No orchards are included in this table with trees under six years of age in 1931.

The avocado industry furnishes further examples of year-to-year and orchard-to-orchard variation in costs of production and yields in fruit growing. Cultural costs vary largely because of soil and topographic differences, and possibly even more because the production of the avocado has not yet become stabilized, and there is no fixed judgment as to what is necessary to produce a profitable crop. Yields vary widely because of the alternate bearing habits of the avocado. because of the differences in ages of trees and in the varieties, and because, as previously indicated, the essentials of production are not vet fully understood.

Hodgson, Robert W., "The California Avocado Industry," University of California Agricultural Extension Service Circular 43, April, 1930. Those interested in the various phases of the avocado industry will find it profitable to consult this circular and also University of California Agricultural Experiment Station Bulletin 539, entitled "Sales Methods and Policies of the Calavo Growers of California," by E. A. Stokdyk, September, 1932.

AVERAGE ANNUAL COSTS OF PRODUCTION, YIELDS, AND INCOME, PER ACRE, AVOCADOS, 1930-1932 TABLE 21

Average cost of water per acre		\$11.50
Totalincome above eosts of production	\$722 92 181 86 755 62 72 61 72 61 747 04 88 22	\$308 55
Total gross income	\$885 60 322 50 876 28 141 25 230 10 261 22 938 54 99 07	\$170 08
Net price to growers per cwt.5	\$20 38 10 91 14 80 17 10 21 92 16 46 7 85	\$1.4 97
Yield, pounds	1,345 2,940 5,940 1,390 1,206 5,702 1,262	3,016
Total cost of production ⁴	\$162 68 1-10 64 120 66 176 77 157 49 155 16 191 50 187 29	\$161.52
Cash overhead ³	\$26 44 16 89 16 89 57 74 41 34 63 42	\$38 71
Material ²	\$15 53 35 54 19 98 115 51 27 57 18 10	\$24.84
Labor	\$100 71 68 63 75 78 75 78 83 53 50 72 66 25 112 40 85 77	\$80.47
Predominant variety	Puebla Fuerte Fuerte Fuerte Fuerte Fuerte Puerte	
Age in 1930, years	FFF67266	00
Area, acres	20.0 20.0 20.0 20.0	oc oc
Serial	— 51 55 ∓ 15 © 1~ ∞	Average

Records for serial numbers 7 and 8 cover 1931 and 1932 only.

Does not include water.

Includes taxes, insurance, and "general" expense.

Includes depreciation of trees at \$20 per acre, but does not include the cost of water or interest on the investment.

All marketing costs deducted.

Not including cost of water or interest on the investment.

Another factor which makes it impossible to reach very definite conclusions regarding the income that ean be expected from avocados is the wide variation in prices received. For instance, the average price obtained in 1930 by individual growers included in the Orange County enterprise efficiency studies reported in Table 21 varied from \$20.40 to \$45.95 per hundredweight. In 1931 the range was from \$7.68 to \$21, and in 1932, from \$6.64 to \$20.27. These price differences are due in large part to differences in market reactions to the numerous different varieties and to differences in time of ripening as between the varieties and as between the various areas in which avocados are being grown. There are, of course, other matters which influence prices, but these need not be taken into account in this report, other than to mention that California must meet heavy competition in avocados, particularly from Florida, Cuba, and Mexico. California production, in so far as handled by the Calavo Growers of California, has increased from 193,800 pounds in 1924-25 to 3.097,332 pounds in 1930-31, and it is estimated that by 1940 the California output will reach 24,000,000 pounds.1

Aside from the higher prices sometimes paid for land favorable to avocado culture, the extra cost of lifting water to such of the higher areas as are used for avocados, and the present higher cost of avocado trees for planting, no reason is apparent why production eosts of avocados should be much more than for oranges or lemons. That they are not seems clear from the average total costs of production given in Table 21. These fall well within the range of production

costs for oranges and lemons.

¹ For this phase of the problem reference is made particularly to University of California Agricultural Experiment Station Bulletin 539, "Sales Methods and Policies of the Calavo Growers of California," by E. T. Stokdyk. See also University of California Agricultural Extension Service Circular 43, "The California Avocado Industry" by R. W. Hodgson.

CHAPTER III

COSTS OF PRODUCTION, YIELDS, AND INCOME, WALNUTS

THE WALNUT INDUSTRY

Walnuts are an important crop in California, especially in the southern part of the State where the California walnut industry started about 65 years ago. The California Cooperative Crop Reporting Service estimates that there were approximately 135,000 acres of walnuts in California in 1932, 22 per cent of which were under six

Walnut acreages for San Diego, Orange, Riverside, San Bernardino, Los Angeles, and Ventura counties, and for the State are shown

in Table 22.

TABLE 22 WALNUT ACREAGE IN SOUTHERN CALIFORNIA COASTAL PLAIN, 19321

Q _{max} t _m		Acreage	
County	Bearing	Nonbearing ²	Total
Los Angeles	27,384	993	28,377
	9,456	114	9,570
	4,987	1,923	6,910
	10,508	1,877	12,385
	1,234	726	1,960
	20,374	4,521	24,895
Totals for counties listed Totals for State Percentage of total State acreage in counties listed	73,943	10,154	84.097
	107,198	27,596	134,794
	69.0	36.8	62 4

¹ From "Acreage estimates, California fruit and nut crops, 1927 to 1932," issued by California Cooperative Crop Reporting Service, Special Publication 117.

² Does not include plantings made in 1932.

Approximately 69 per cent of the bearing walnut acreage of the State and approximately 37 per cent of the nonbearing acreage lies within these six counties. The relatively low percentage of nonbearing acreage indicates that the center of production is moving toward the north. The manager of the California Walnut Growers Association. in his report for season of 1931, states that 32 per cent of the State crop was being produced north of the Tehachapi.

A few years ago, when very high returns were being received from oranges, some walnut growers removed their walnut trees and substituted oranges. These substitutions were made mostly in Orange County. However, the reduction of walnut acreage by changing to oranges was more than offset by the increase in new walnut plantings,

particularly in the northern part of the State.

Table 23 gives a long-time record of bearing acreages, production,

and average yield per aere for California walnuts.

Erdman and Fuhriman, in University of California Agricultural Experiment Station Bulletin 475, "Walnut Supply and Price Situation," report that the trend of walnut production in California has shown an average annual increase of 6.5 per cent over the period 1895 to 1928. The production of the last few years has caused no marked deviation from this trend.

TABLE 23
WALNUT ACREAGE AND PRODUCTION IN CALIFORNIA, 1914-19321

Year	Bearing area, acres	Production, tons (unshelled)	Average yic!d per acre, pounds
1914	34,138	8,900	521
1915	34,453	14.825	\$60
1916	35,379	14,600	825
1917	45,687	16,500	722
1918	48,520	19,950 28,100	822
1919	50,900 58,963	21,000	1,104 712
1920	61,781	19,500	631
1922	65,530	27,000	824
1923	66,951	25,000	747
1924	68,572	22,500	656
1925	69,629	36,000	1,034
1926	71,779	15,000	417
1927	81,118	51,000	1.257
1928	84,934	25,000	589
1929	89,155	39,000	875
1930	97,453	31,000	636
1931	102,575	28,950	564
1932	107,198	44,000	\$21

¹ Bearing acreages from "California Crop Report, 1927" and "Acreage estimates California fruit and nut crops, 1927-1932," issued by California Cooperative Crop Reporting Service, Special Publications 86 and 117. Production for 1914 to 1928 from "California Crop Report, 1927"; for 1929 and 1930 from U. S. Department of Agriculture "Yearbook of Agriculture, 1931," p. 745; for 1931 and 1932 from University of California Agricultural Extension Service Circular 71, "The 1933 Agricultural Outlook for California," p. 53. Average yields have been computed from the figures for acreage and production given in the table.

Production in the United States.

The United States Census of 1930 reports that approximately 89 per cent of the bearing and 76 per cent of the nonbearing walnut acreage of the United States is found in California, while Oregon has about 10 per cent of the bearing acreage and 22 per cent of the nonbearing. Production in the latter State should increase rapidly. Ninety-nine per cent of the bearing and 98 per cent of the nonbearing acreage is found in California and Oregon.

Pecans and almonds are competing nut crops, over 99 per cent of the latter being produced in California. Pecans, however, have been planted in large numbers throughout the Southern and Southwestern States.

Importations.

The nut supply of the United States is augmented by importations from France, Italy, and China. The yearly importation of walnuts during the period 1908 to 1930, in terms of unshelled nuts, averaged 72.095 tons.¹

Environmental Factors.

Walnut trees do best on deep, well-drained, medium-textured soils. Rather wide ranges in soil texture can be tolerated, but shallow or poorly drained soils can not.

¹ Computed from "shelled" importations as given in U. S. Dept. of Agr., "Yearbook for Agriculture, 1931," p. 951.

Climatic conditions favorable to lemons or Valencia oranges seem to be well suited to the growing of walnuts, except in warmer areas where lack of winter cold results in delayed foliation. The walnut tree, however, can withstand very low temperatures during the dormant season. Extremely high summer temperatures cause sunburning of the nuts, which materially affects the quantity and quality of marketable product. The percentage of high-quality nuts usually is greater in the coastal sections,

Cultural Practices.

Intercropping young walnut orchards with row crops is a common practice. The large lima bean is a favored intercrop in the Ventura area. Truck crops and sometimes early maturing fruit trees, such as peaches, are also planted in the young orchards.

Pruning in a walnut orchard consists chiefly in thinning out to permit sunlight to enter. Usually the trees are planted more closely than would be desirable for a mature orchard. This makes necessary

the removal of some trees when they begin to crowd each other.

The application of commercial fertilizer is not commonly practiced in the growing of walnuts.

The insects chiefly affecting walnuts are codling moth, walnut aphis,

red spider, walnut husk fly, and Italian pear scale.

Walnut blight, Melaxuma, crown gall, little leaf, crown rot, and nematodes on light soils cause considerable trouble. Winter injury or die-back has been very troublesome, especially in parts of area W2 (see p. 65).

Quality of Walnuts.

As mentioned previously, high summer temperatures directly affect nut quality. The season of 1931 experienced abnormally high temperatures, resulting in such poor quality that only one-third of the crop handled by the association was shipped under the Diamond brand. The quality of this crop was the poorest the association has shipped during the twenty seasons the association has been in existence.

Prices of Walnuts.

With but few exceptions, packing-house grade requirements have changed from time to time. This makes it difficult to compare prices over a long period. Diamond brand No. 1 soft shells (seedlings), however, have had a fixed standard over a long period. It is possible, there-

fore, to indicate changes in price of this grade of nuts.

The average price per pound to the local association for Diamond No. 1 for the 1909–1913 crops was 14.6 cents. Using this price as an index figure of 100, changes in the average annual price of this grade of walnuts—the highest grade of seedling nuts—are shown in Table 24. The index values in most cases have been higher for walnuts than for prices paid and prices received by the farmers.

Yield and Quality.

Long-time packing-house records on quality and size of pack are available, but a careful census of the acreage served by the California Walnut Growers Association is at hand only for the years 1930 and

1931. This census groups the trees into three divisions, viz: nenbearing, 1 to 5 years of age; part bearing, 6 to 15 years; full bearing, 16 years and over. On the basis of these groups the average yields per acre have been computed, part bearing acreage being given a half value.

TABLE 24

AVERAGE PRICES RECEIVED BY LOCAL ASSOCIATIONS FOR DIAMOND NO. 1 SOFT SHELL WALNUTS (SEEDLINGS), TOGETHER WITH INDEX FIGURES FOR WALNUTS, FOR ALL COMMODITIES WHOLESALE PRICES, AND FOR ALL FARM PRODUCTS, 1919-1932. 5-YEAR BASE 1909-1914

	Average price per		Index figures	
Year	pound for Diamond No. 1 soft shell walnuts, cents	Walnuts, Diamond No. 1 soft shell	Average for all eommodi- ties wholesale price	Farm prices, all groups
Average, 1909-1914 1-1919	14.6 30.2 20.6 24.0 21.3 20.7 23.6 21.9 26.2 18.4 24.6 18.0 19.5 17.9	100 207 141 164 146 142 162 150 179 126 168 123 134 123 103	100 205 206 156 152 153 154 159 156 154 156 155 146 126	100 209 205 116 124 135 134 147 136 131 139 138 117 80

Walnuts, 1909 to 1913; other commodities, August, 1909, to July, 1914. Data on walnuts from California Walnut Growers Association. Data on other commodities from "The Agricultural Situation," U. S. Dept. of Agr., Bur. of Agr.

The record of yields secured by this method no doubt indicates yields lower than would be secured with a long-time record, since the

quality of the 1931 crop was the lowest of record.

Table 25 presents the packing-house data on yields per acre for 1930 and 1931, and quality of crop for the period 1926 to 1932. The yields presented indicate relative differences between the areas rather than the yields that may be secured. The high maximum temperature of the summer of 1931 caused reduced yields, especially in the areas removed from the coast.

TABLE 25

AVERAGE YIELDS PER ACRE AND AVERAGE PERCENTAGE OF WALNUTS IN THE VARIOUS MARKET GRADES AS SHOWN BY PACKING-HOUSE RECORDS

Data from California Walnut Growers Association

	Number of	Average y	ields per aei	e, pounds	Peree	entage in each	grade, 1927-	1932
Area	packing houses represented	1930	1931	Average, 1930-1931	Diamonds	Emeralds	Off grades	Total
%-1 %-2 %-3 %-4	9 8 4 3	717 450 1.173 701	361 318 638 732	539 384 906 716	51 5 34 8 80 9 51 1	38 5 40 1 11 2 34 2	10.0 25.1 7.9 14.7	100 100 100 100

WALNUT AREAS COVERED IN THE STUDY

The main walnut sections included within these studies have been grouped into four broad areas. The areas have been designated W1, W2, W3, and W4. This grouping is chiefly geographical and to bring into single areas the walnut districts which are contiguous. However, climatic conditions have also been a factor especially as between areas W1 and W2 and as between areas W3 and W4.

Area W1 includes the walnut districts of Orange County, exclusive of the La Habra district.

Area W2 takes in Chino, Pomona, Puente, West Covina, El Monte, Whittier, La Habra, and Rivera.

Area W3 covers the intermediate and coastal districts of Ventura County.

Area W4 includes the walnut districts at Moorpark and in Simi Valley.

The above divisions into areas have not taken into account all of the factors some of those familiar with the walnut industry recognize. For instance, the coastal belt, as a rule, produces nuts having a light-colored kernel which brings quality prices. Nuts to be placed in the Diamond brand must be at least 90 per cent sound and 60 ¹ per cent light-colored.

The relatively low percentage of Diamond brand nuts reported for area W2 results mainly from heavy infestations of codling moth.

DATA RELATING TO COSTS OF PRODUCTION, YIELDS, AND INCOME, WALNUTS²

Eighty-four Agricultural Extension Service cost-of-production and yield records for walnuts have been used in the present study. Orange County provided eighteen 2- to 3-year records for the period 1929–1931; San Bernardino County, ten records covering the same period; Los Angeles County, forty-one 2- to 5-year records covering the period 1927–1931; Ventura County, fifteen 2-to 4-year records, obtained during the period 1928 to 1931. The records for 1932 were not available when the computations for most of the walnut tables were made. The yields for 1932, however, have been added to the records of previous years in computing the average yields used in preparing the frequency distribution of yields given in Table 28.

In order to determine the representativeness of the sampling, over 80 per cent of the orchards, for which cost records have been used, were visited. The conclusion was reached that the records gave a very good cross-section of the going orchards. They are not, however, representative of orchards about to go out of production. Orchards in parts of area W2, in particular, have been heavily damaged by

what the industry knows as "die-back."

¹ Changed to 50 per cent for 1933. ² For general discussion of the principles which have guided the use of the costof-production data see Chapter I, pp. 23 to 28.

AVERAGE ANNUAL COSTS OF PRODUCTION AND YIELDS OF WALNUTS, PER ACRE, BY SPECIFIED AREAS. Data summarized from Table D, Appendix TABLE 26

Total	togrower	\$144 17 121 59 340 59 176 0 5
Yield.	pounds	910 736 1,689 1,006
Cost of	water	\$11 78 12 83 14 32 11 00
d	Deprecia- ation	\$6 58 7 20 5 74 9 93
	Insurance	\$0 58 35 443 38
cre	Taxes	\$29 04 18 65 20 55 19 10
Average costs per acre	General	\$4 03 3 40 4 66 4 87
Aver	Labor	\$29 86 23 64 24 32 25 35
	Material2	\$8 11 3 16 2 41 1 47
	Total:	\$78 19 56 41 58 11 61 12
Average	length of record, years	21 85 35 35 85 35 35 95 35 35
	Average area, acres	13 6 21 3 29 3 59 2
	Number of records	8122
	Area	W-2 W-2 W-4

¹ For description of areas, see p. 65.
² Does not include cost of water but does include costs of harvesting.
² Does not include depreciation of trees.
⁴ Average of 44 records.

Tabulations of Costs, Yields, and Income.

Data on costs, yields, and income are presented in part in 3 tables. Table D, in the appendix, gives the average cost of production, yields, and with few exceptions, returns to the grower, for each record. Table 26 gives the average annual cost of production, yields, and income per aere for walnuts in each of the four areas studied. Only three records are available for area W4. While this is a very limited number to put into a separate group, the field inspection and the records, both Agricultural Extension Service and packing house, justified such a separation. Itemized costs of labor and material are presented in Table 27. Costs are much lower than in the case of citrus, especially the cost for material.

TABLE 27

AVERAGE AMOUNTS PAID ANNUALLY PER ACRE BY GROWERS, BY SPECIFIED AREAS, FOR THE VARIOUS ITEMS OF LABOR AND MATERIALS USED IN THE PRODUCTION OF WALNUTS AS SHOWN BY 84 AGRICULTURAL EXTENSION SERVICE RECORDS

Item		Area	11	
Acein	1 (18)2	2 (51)	3 (12)	4 (3)
LABOR Irrigation Fertilizer Cover crop Disease control Parasite Frost protection Bracing Pruning and brush disposal Cultivation Miscellaneous MATERIAL Fertilizer Cover crop seed Disease control Parasite control	\$8 57 20 03 26 4 74 0 13 2 79 12 78 36 2 30 15 20 5 35	\$7 30 05 22 29 2 61 14 31 3 11 9 06 55	\$8 80 08 11 06 1 42 0 13 3 68 8 68 1 35 07 35 0 1 61	\$7 69 27 0 0 51 0 75 2 07 9 77 4 30 36 0 0 78
Frost protection Miscellaneous	12	03 26	38	, 0

¹ For description of areas, see p. 65.

The above tables present costs as reported by the Agricultural Extension Service, no deductions having been made to conform to changed prices, nor has anything been included for tree depreciation, which needs to be added to conform to the plan of determining costs of production outlined in Chapter 1. In the main, the Agricultural Extension Service has computed depreciation of walnut trees as follows:

"Tree values are computed from a replacement schedule based on sixty years life for an average commercial walnut orchard. The values starting at \$75 the first year were appreciated \$27 per year to the 12th year and then \$18.75 to a maximum value of \$550 per acre the 20th year. A depreciation charge of 2.5 per cent per year, or \$13.75, is made from the 21st to the 60th year."

Some of the walnut orchards listed in the present study are under 20 years of age. If the method of depreciating trees followed by the Agricultural Extension Service were to be used, no allowance for

² Figures in parentheses indicate number of records represented.

¹ From: Wahlberg, H. E., "Summary of Cost and Efficiency Analysis on Walnut Production, Orange County, 1931." (Mimeographed report.)

depreciation would be made for such orehards. The California Walnut Growers Association, however, classes trees 16 years of age as full bearing. It has been concluded that the period during which depreciation of walnut trees is to be charged can well be extended to 45 years; that is, from the 16th to the 60th years.

According to the Agricultural Extension Service figures, the investment per acre in a walnut orehard at the end of the 15th year is about \$430. A straight-line depreciation of this amount extending over a 45-year period results in a depreciation allowance of approxi-

TABLE 28 FREQUENCY DISTRIBUTION OF YIELDS OF WALNUTS, BY SPECIFIED AREAS

Figures in area columns indicate number of orchards in each yield group

Range in yield,		(A)	ea ¹		Totals	
pounds per acre²	1	2	3	4	Totals	
300- 350		1			1	
		1			1	
350- 400					1	
400- 450		1			1	
450- 500		1			1	
500- 550		7			1	
550- 600		4			5	
600- 650		6			6	
650- 700		3	1		4	
700- 750		3			3	
750- 800	1	4			5	
800- 850		4			4	
850- 900		2			2	
900- 950	. 1	1			2	
950-1,000	_			2	3	
1,000-1,050	i	5			6	
1,050-1,100	1	2			3	
1,100-1,150	i	2			3	
1,150-1,200						
1,200-1,250	2	2)	5	
1,250-1,300	~	_ ~		_ ^	· ·	
1,300-1,350		1	9		3	
	1	1	-		1	
1,350-1,400	- 1				1	
1,400-1,450	2				2	
1,450-1,500					4	
1,500-1,550	3		1		4	
1,550-1,600					3	
1.600-1,650			2		_	
1,650-1,700	1				1	
1,700-1,750						
1,750-1,800		1			2	
1,800-1,850						
1,850-1,900			1		1	
1,900-1,950						
1,950-2,000.			1		1	
2,000-2,050		1-				
2,050-2,100						
2,100-2,150.						
2,150-2,200						
2,200-2,250			2		2	
2,250-2,300						
2,300-2,350			I		1	
2,350-2,400						
2,400-2,450						
2,450-2,500						
2,500-2,550.						
2,550-2,600						
2,600-2,650						
2,650-2,700.			1		1	
2,000 2,100.						
Totals	. 18	51	12	3	84	

¹ For description of areas, see p. 65. ² Lower limit inclusive.

mately \$10 per acre per annum. This figure has been adopted in the computations of cost of production of walnuts given below in Tables 29 and 30.

A frequency distribution of yields of walnuts by specified areas, as shown by 84 Agricultural Extension Service records for the period 1927 to 1932, is presented in Table 28. The walnut yields during the seasons of 1930 and 1931 were comparatively low.

TABLE 29

FREQUENCY DISTRIBUTION OF RESIDUAL INCOME FROM WALNUTS ABOVE COSTS OF PRODUCTION OTHER THAN THE COST OF WATER. PRODUCTION COSTS WERE COMPUTED ON A 1927-1929 COST AND WITH RETURNS TO GROWER AT AN AVERAGE PRICE OF 201 CENTS A POUND2.

Cost-of-production and yield data from Agricultural Extension Service records

Costs include the cost of harvesting

Net return per acre, exclusive of			Area		
water and interest on investment 3	W-1	W-2	W-3	W-4	Totals
\$-70-\$60		1			1
60- 50 50 40		1			1
-40- 30					-
-30- 20 -20- 10		2			2
-10- 0 0- 10		2 5			2 5
10 - 20		4			4
30- 40	1 1	7 5			8 6
40- 50 50- 60	1	3 5	1		3 7
60- 70 70- 80	2 4	1			3 6
80- 90	2 2	2 4			4 6
90-100 100-110		3			3
110-120 120-130	2	1		1	1 3
130–140 140–150	1				1
150-160		1			1
170-180	2		1		2
180-190 190-200			1		1
200-210 210-220			1		1
220-230		1			i
240-250					
250-260 260-270			1		1
270–280 280-290					
290-300 300-310			1		I
310-320			4		4
320–330 Over 330			31		1
Totals	18	49	12	3	82

The average price per pound to the grower for all grades for the period 1928-1929 was just slightly under 20 cents.

For method of computation used, see text, p. 71.

\$409.

Residual Income From Walnut Production Above Other Costs Than the Cost of Water.

As in the case of citrus fruits, an attempt has been made to determine the residual income above costs of producing walnuts with costs of production adjusted to lower price levels and with varying prices for the product. However, the cost data for walnuts presented in

³ Lower limit inclusive.

FREQUENCY DISTRIBUTION OF RESIDUAL INCOME FROM WALNUTS ABOVE COSTS OF PRODUCTION OTHER THAN THE COST OF WATER WITH AVERAGE PRICES FOR WALNUTS OF 18, 16, 14 AND 12 CENTS A POUND TO THE GROWER. COSTS OF PRODUCTION 25 PER CENT LESS THAN THE AVERAGE FOR 1927-1929:

Cost-of-production and yield data from Agricultural Extension Service records

Costs include the cost of harvesting

								Ar	ea							
Net return per aere, exclusive of water and interest on investments ²		W	-1			W-:	2			W-3	3			W.	-1	
	18	16	14	12	18	16	14	12	18	16	14	12	18	16	14	1
-7 0-\$60								1								
-60- 50							1	^								
-50- 40						1	1 1	1								1
-40- 30					1	î	1	ī								
-30- 20					i		1	1								
-20- 10						2 2 3	1.1	6								
-10- 0				1	2	$\bar{2}$	5	7								
0- 10				1	2 2	3	6	9								
10- 20			2	2	3	6	10	7								L.
20- 30		1		2 5	5	8	5	4				1				
30-40	1	1	2 5	2	8	6	5	2			1					l
40- 50	l ī	ī	5	2	6	5	2	5							1	١.,
50- 60	l î	ī	3	3	5	2	2	3		1						l
60-70-		5	1		2	2	5		1					1		
70- 80	3	2	ī		2	4	3									l.,
80- 90	3	2	2	2		3		1				1	1		1	
90-100	3				4	3						1		1	1	
100-110		2			3		1				1	1				-
110-120	1	1	2		3			1				1	1	1		
120-130	Ιŝ	1	_			1					1					
130-140	1					-			1	1	li					
140-150	l î	2			1		1				1	1	1			
150-160	-	_			-					1		l				
160-170									1	1		1				
170-180	2									1	1	3				
180-190						1			1			1				-
190-200.	1		}			1			1							١.
200-210				1					1		1					
210-220					1					1	1		1			
220-230					1						3	1				
230-240					1					1						
240-250					1				1	l						
250-260									1							
260-270							1			4						
270-280	1					1	1	1	1							
280-290	1						1				1					
290-300					1	1										1.
300-310			1	1					3							
310-320					1				1					1		
320-330																
330-340										1						
340-350																1.
350-360			1													
360-370																
370-380																
380-390							- 0 - 0		1							
000 000															-	
Totals.	. 18	18	18	18	49	49	49	49	12	12	12	12	3	3	3	

¹ For basis of computation and reduction, see text, p. 71.

Table D in the appendix are less representative of the production and marketing conditions of the period through which the records were selected than are those for citrus fruits. A majority of the citrus records were continuous over a four-or five-year period and therefore included years of both high and low price levels. Many of the walnut records, on the other hand, are for two years only, some falling within the years of high price levels of 1928–1929, while others are for 1930 and 1931, which are years of lower prices. In order to make the cost

² Lower limit inclusive.

records comparable, the records have been adjusted so as to put them all on the 1927-1929 price level.

In making this adjustment to a common price level, the procedure has been as follows: labor has been figured at 50 cents an hour, material—largely spray material—has been charged at the 1927-1929 average price, and harvest costs have all been refigured to conform to the 1927-1929 average harvesting eosts. Since there were no signifieant changes in taxes, depreciation, and insurance, the amounts covering these items have remained as reported.

TABLE 30A

COMPUTED ANNUAL INCOME PER ACRE FROM WALNUTS AFTER ALLOWING FOR DEPRECIATION AND PAYING ALL COSTS OF PRODUCTION AND HARVESTING, EXCEPT THE COST OF WATER, WITH AVERAGE PRICES FOR ALL GRADES OF MARKETABLE WALNUTS OF 18, 16, 14, AND 12 CENTS A POUND, NET TO THE GROWERS

	18 cen	its	16 ce1	nts	14 cen	ts	12 cer	nts
Area	A1	B ²	A^{1}	B ²	A1	B ²	A1	B2
W-1 (18) ² W-2 (49) W-3 (12) W-4 (3)	\$92 93 257 117	\$80 35 208 120	\$72 68 220 97	\$62 24 177 100	\$52 43 184 77	\$44 11 147 80	\$33 18 147 56	\$23 0 116 60

Average of middle half of the growers.

² Figures in parentheses indicate number of records.

The data regarding residual income from walnut production above other costs than the cost of water are presented in tables 29, 30 and 30-A. Table 29 is a frequency distribution showing the residual income above eosts other than for water with costs of production as they averaged during the period 1927-1929,2 and with average prices for all grades of marketable walnuts of 20 ° cents a pound to the grower. Table 30, which is also a frequency distribution, shows the residual income with easts of production reduced 25 per cent from the 1927-1929 average and with average prices for walnuts of 18, 16, 14 and 12 cents a pound to the grower. As in the case of Table 28, the yields used in computing these two tables include those for 1932, Table 30-A shows the residual income above other costs than the cost of water by areas with prices of 18, 16, 14, and 12 cents per pound, net to the grower.

Quality, which varies greatly in walnuts, is reflected in price. In order to reduce prices received by the various growers represented in the cost-of-production studies to a common basis, the relation between the average price per pound received by each grower and the average price received by the industry as a whole during the same period was determined and expressed as a "quality percentage"

³ Growers of least residual income in the upper two-thirds group. (For discussion of this grouping, see text, page 27.)

¹ In collecting cost data on walnuts, the Agricultural Extension Service allowed, on the average, a price of 50 cents an hour for labor during the years 1927-1929, 45 cents during 1930, and 40 cents during 1931.

² Production costs for citrus fruits were reduced 25 per cent from an average of 1926-1931 costs, which was a lower base than the 1927-1929 base used for walnuts. Material costs make up a large part of the citrus costs of production. This is not the case with walnuts. Costs which are more difficult to reduce, such as taxes, make up a proportionately large part of the production costs of walnuts.

³ The average return to the grower for all grades of marketable walnuts for the period 1928-1929 was slightly under 20 cents a pound.

factor. For example, if the average price of nuts to all of the growers over the period being considered was 20 cents a pound, and the average price received by an individual grower was 16 cents, the percentage relation in this case would be 80. This quality percentage factor was used in computing the residual income above costs other than the cost of water in tables 29, 30, and 30-A.

CHAPTER IV

DECIDUOUS FRUITS, GRAPES, FIELD CROPS, AND TRUCK CROPS

GEOGRAPHICAL DISTRIBUTION AND ACREAGES

The geographical distribution of the crops discussed in this chapter as far as they are located in Santa Ana, San Gabriel, Los Angeles, and Santa Clara River valleys and local tributary areas, is shown in a general way by the two colored maps accompanying this report (Plates A and B in pocket).

The map of the south coastal basin, which includes the three first-named valleys, does not differentiate between walnuts, the fruits ordinarily classed as "deciduous"—such as apricots and peaches—and grapes, but shows the location of "garden and field crops," "alfalfa," and "irrigated grass" separately from the other crops of the basin.

In the case of the map covering Santa Clara River Valley and adjacent areas in Ventura County (Ventura County Investigations). "apricots, miscellaneous trees, and grapes" are grouped together separately from walnuts, and "beans, beets, and hay," "alfalfa," and "truck and miscellaneous gardens" are each given designations.

These two maps therefore present only a general picture of the irrigated-erops distribution, aside from eitrus fruits and also aside from walnuts, which are designated separately on the Santa Clara River Valley map. Furthermore, they do not extend into San Diego County. The approximate aereage of these crops in the portion of the southern coastal plain covered in the present study and the locations of the principal plantings are as follows:

SUMMARY OF ACREAGES OF DECIDUOUS TREE FRUITS, GRAPES, AND FIELD AND TRUCK CROPS

Deciduous Fruits	Area, acres	FIELD CROPS ¹	Area, aeres
Apricots	4,400	Lima beans	85,600
Peaches	7,800	Other beans	13,000
Other	7,300	Sugar beets	23,100 3,600
Approximate total	19,500	Other	3,000
		Approximate total	125,300
Grapes ¹		m	
All varieties	31,100	Truck Crops ¹	
		Potatoes.	9,200
Forage, Grain and Hay Crops ¹		Lettuce	4,400
Alfalfa	63.800	Berries.	3,900
Barley	14,000	Tomatoes	6,800
Corn	2,300	Other	40,700
Other	165,800	Approximate total.	65,000
Approximate total	245,900		

¹ Figures include areas in Los Angeles County outside of coastal plain. See discussion in text following summary.

The study has covered the valley and the cultivable foothills and rolling lands of Ventura, Los Angeles, Orange, San Bernardino, Riverside, and San Diego counties which drain into the Pacific Ocean, with the exception of the following: Santa Clara River Valley east of the Ventura-Los Angeles county line; San Fernando Valley in Los Angeles County: San Jacinto River drainage, in Riverside County; and the minor interior coastal plain areas, chiefly in San Diego County.

Important as are eitrus fruits and walnuts in the southern California coastal plain, it will be seen from the above summary that there is a very large acreage in other crops, particularly under the classifications "forage, grain, and hay crops," "field crops," and "truck crops." In the summary above the figures for these three groups, and also for grapes, include all of Los Angeles County, rather than only that portion which falls within the coastal plain. However, the acreage of these crops in Los Angeles County outside of the coastal plain is not large, except for alfalfa. There is a substantial acreage of this crop in Antelope Valley, which lies outside of the coastal plain.

From the standpoint of irrigation and water costs, the important crops listed in the summary are deciduous fruits, alfalfa, beans, sugar beets, and truck crops, these together making up an area in the coastal plain exceeding 250,000 acres.

Of the deciduous fruits, peaches have the largest acreage. They are found mainly in San Bernardino County near Wineville, Alta Loma, and Chino. There are also important acreages of peaches in San Fernando Valley and around Pomona in Los Angeles County, and in various valleys in San Diego County. Apricots, which come next in acreage, are grown chiefly in Santa Clara River Valley and adjacent valleys in Ventura County. There are also scattered acreages of apricots in each of the other five coastal counties.

The principal grape acreage is in San Bernardino County, eentering around Highlands, Fontana, Etiwanda, and Wineville. Nearly 5000 acres of grapes are found in San Diego County, mainly in Escondido and adjacent valleys and out from El Cajon. Riverside has about 1500 acres of grapes, eentering around Corona and West Riverside; Los Angeles County, about 3600 acres, chiefly in San Fernando Valley. from Glendale north. A substantial part of the grapes are not irrigated.

The alfalfa acreage is rather widely seattered in the six southern coastal plain counties, and in some of the main lima bean and sugar beet areas is a rotation erop with beans and beets. In San Diego County it is found principally in the small interior valleys, in Riverside and San Bernardino counties largely along the Santa Ana River lowlands, and also in the Arlington Heights section of Riverside County and in the Chino section of San Bernardino County. Most of the alfalfa in Orange County is in relatively small tracts west and south of Santa Ana. In Los Angeles County, as stated previously, the principal part of the alfalfa acreage is outside of the coastal plain. Most of that in this county lying within the coastal plain is in San Fernando Valley. In Ventura County it is chiefly in the Oxnard plain and smaller valleys leading off from it.

Of the field crops mentioned as being of main importance from the standpoint of irrigation and water costs, lima and other beans are clearly first and sugar beets second. The lima bean areas are all in the coastal belt—about 15,000 acres in San Diego County, approximately 28,000 acres in Ventura County, over 40,000 acres in Orange County, and over 14,000 acres in Los Angeles County. Much of the present bean acreage is interplanted in young orehards. The Oxnard plain of Ventura County, the southwestern portion of Orange County, and the southeastern portion of Los Angeles County raise the principal

quantities of sugar beets. Only the truck crops with largest acreages are listed in the summary above. With both truck and field crops the acreage varies from year to year. The soils best suited to truck crops are usually located near the lower ends of the alluvial fans where a water supply can be developed rather cheaply, or on the alluvial soils farther back along the main rivers.

It will be seen from the statements made above that in many instances deciduous fruits and field and truck crops are grown in areas not suited to such plantings as citrus fruits, walnuts, and There are substantial areas in the southern coastal plain which can be so classed. Being less affected by frost than citrus fruits, deciduous plantings tend to occupy the lower areas contiguous to the eitrus groves, as well as areas at an elevation too high for eitrus, such as around Beaumont, Yucaipa Valley, and to a limited extent in the back country of San Diego County. Deciduous fruits are also found in areas suitable for eitrus where the water supply is limited, since the seasonal requirement for deciduous fruits is less than for citrus. An example of this is the peach area in western San Bernardino County and the apricot area in Hemet Valley.

Field and truck crops found in the sections of the southern coastal plain which are adapted to citrus fruits and walnuts are grown there partly as intercrops, partly as temporary crops pending extension of orehard plantings, and partly because some of these crops tend to maintain themselves against the competition of permanent plantings, since in good years the returns from them are substantial and the investment necessary for growing them is much smaller than for permanent plantings. Furthermore, the double plantings possible in the long growing season of the southern coastal plain increase the ability of the annual crops to compete for the available land and water with orchards.

COSTS OF PRODUCTION, YIELDS, AND INCOME

Questions connected with the value and cost of irrigation water for deciduous fruits and field and truck crops are important and will continue to be so, because of the permanent place these crops now occupy and will continue to occupy in the agriculture of the southern coastal plain. The cost of providing water is, of course, not affected by the use to which it is put. Consequently, the amounts farmers are paying for water for deciduous fruits and field and truck crops in areas chiefly devoted to higher-priced products tend to be the same as for the latter. However, since the bulk of the field and truck crops are in the lower elevations, where the pumping lift is less than in the main orchard areas, water costs for those crops are generally lower.

Data regarding the cost of production, yields, and income for the crops discussed in this chapter are meager, but are included as tables 31, 32, and 33. The first of these tables gives the east of production and of harvesting, the yields, and the returns per acre for ten lima bean growers in Orange County. The next gives similar information for ten apricot orchards in Riverside County, mostly in Hemet Valley. Although this valley was not covered in the present investigation. the data are included because they furnish the only cost-of-production records for deciduous fruits that have been obtained.

AVERAGE ANNUAL COSTS OF PRODUCTION, YIELDS, AND TOTAL RETURNS TO THE GROWER PER ACRE FOR LIMA BEANS, ORANGE COUNTY Data from the Agricultural Extension Service. Nothing included for interest on the investment TABLE 31

Residual	per acre above all costs except eost of water	\$50 33 98 88	82 39 93 50	42 38 57 24			99 35	\$83 21
Resi		44			_	•		•
Total cost	producing and harvesting, not including cost of water	\$57 96 57 90	53 81 56 77	44 78 54 83			59 25	\$56 01
Tota	prod a a harv- n ineh eos	4/3					84.0	G0
	Total returns to growers	08 29 56 78	136 20 150 27	87 16 112 07			158 60	\$139 24
	T. ret	\$108					-	*
	cwt.	18.57	19 72 14.35	11.35	00.71	19.81	22 56	17.12
	Cost of water	\$3 60 3 68	5 78 1 53	2 16 2 07			1 71	\$3 08
	Co w.							
	Cleaning	\$3 00	1 64 3 66	2 50 2 50 2 50 2 50 2 50 2 50 2 50 2 50			2 91	19 83
sts	Cle							
Harvesting costs	Bags and twine	\$1 06 1 85	1 62 1 83	1 01		2 76	1 98	\$1 47
arves	t _a a				1			
H	Field	\$10 01	11 72 13 03	9 26 7 87			12 03	\$10 66
		efo						4
	Depreciation on improvements and equip-	\$2.54 2.21	2 07 3 00		2 56		4.55	\$2 60
	Dep tio imp men eq eq			!				
	Taxes	\$6 67 9 58	5 00 10 00	6 94 6 89			11 58	\$8 32
9	E							
Preharvest cost per acre	General	\$2 49 2 37	2 50 2 30	1 91 2 15			2 1.6	\$2 29
eost j	Ge							
arvest	Labor	\$23 91 17 65	20 53 14 88	16 49			17 23	\$18 13
Preh		66						80
	Material	\$8 28 9 87	8 7.8 8 07	6 68 12 86	10 80		6 83	\$8 63
	Mai							
	Total	\$13 89 41 68	38 83 38 25	32 02 42 58	14 76	13 97	42 33	\$10 27
	T	U)						90
	<u>-8</u>	331		0		1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
	Years covered by records	929, 19	1931.	929, 1931, 29,193	90	1 1	28, 1929, 1930, 1931.	Averages.
	by	928, 1929, 1931 928, 1929, 1930 038, 1930	1930, 193	928, 1929, 1930, 1931 928, 1929, 1930	928	1928	1928, 1929 1930, 19	Av
	ad oer							
	Serial	75	78	08	818	3 SS 1	20	

Cost of water not included.

TABLE 32

AVERAGE ANNUAL COSTS OF PRODUCTION, YIELDS, AND TOTAL RETURNS TO THE GROWER PER ACRE FOR 10 APRICOT ORCHARDS IN RIVERSIDE COUNTY

Data from the Agricultural Extension Service. Nothing included for interest on the investment or for depreciation on improvements and equipment

Residual	per acre above all costs except cost of water	\$166 17 102 38 102 38 59 29 33 94 105 14 129 32 419 10 178 64 170 52
Total cost	producing and harvesting, not including cost of water	\$260 55 69 61 146 17 203 63 140 46 193 34 193 72 189 74 184 51 153 84
	Total returns to grower	\$426 72 106 50 262 95 262 95 174 40 2298 48 2298 48 2298 48 363 15 363 15 363 15 363 15
	Yield, tons	6 5 6 6 8 8 8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9
	Cost of water	\$14 38 17 51 17 51 18 84 19 52 19 52 113 90 113 90 16 34 \$16 44
	Harvest- ing costs, picking, hauling, drying	\$155 61 52 06 62 02 147 34 74 47 124 11 51 158 141 04 84 84 34 89 6 94
	Other eash costs	\$0 08
	Taxes	\$13 29 8 92 12 94 10 16 9 62 10 42 8 71 8 71 9 32 \$10 35
Preharvest costs per acre	General	\$11 78 2 54 6 04 7 99 7 99 04 7 6 9 0 04 7 6 10 76 9 0 04 7 64 7 64 7 64 7 64 7 65 9
reharvest co	Labor	\$74 71 51 10 53 10 53 89 34 44 48 32 47 00 20 63 19 95 45 85 45 85 45 85
	Materiul	\$5 16 3 02 3 02 4 4 8 94 4 4 8 94 3 15 6 8 87 7 16 07 7 15 858 82
	Total!	\$10.5 84.5 58 4.5 58 4.5 58 29 65 99 65 99 74 74 79 67 79 67 69 50
	Years covered by records	1926, 1927, 1928, 1929 1926, 1927, 1928, 1929 1926, 1927, 1928, 1929 1926, 1927, 1928, 1929 1926, 1927, 1928, 1929 1928, 1929 1928, 1929 1928, 1929
	Serial	-00×10×0×00

1 Cost of water not included.

\$112 40

\$155 30

14 30

\$3.48

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65 \$15

68 \$ 13

138 2

Averages.

ANNUAL COSTS OF PRODUCTION, YIELDS, AND RETURNS PER ACRE FOR 29 LIMA-BEAN GROWERS IN VENTURA COUNTY, 1929 Data from California Lima Bean Growers Association. Nothing included for interest on the investment TABLE 33

				Production eost	on costs				JH.	Harvesting costs	ts		Total retur	Total return to grower!
Serial	Acres	Total	Labor	Material	Irriga- tion ¹	General	Depreciation on improve- ments and equipment	Taxes	Field	Вадз	Recleaning	Yield, cwt. per acre	At \$10.86	At \$7.86 per cwt.4
							IRRIGATED	ED LAND						
Col	95		\$10.16								\$4.76	15.04	\$163 33	\$118 21
	10		21.46		_			19 86			2 45	14 75	160 10	115 94
6 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	400		11 75	4 80	_	2 00	6 45			200	1 50	9.75	105 88	76 61
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1	80		12 75	2 00	_					1.25		10.00	108 60	78 60
	170		25 00			3 00	1 1 1 1 1 1 1 1					17.56	190 70	138 05
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1 1 1 1 1 1 1 1 1 1	30	29 60	11 99	28.0	9 6	2 13	2 27	10 67 8 00	212	1	0 S	21,83	101 32	73 33
1 1 1 1 1 1 1	75		17 16							101	2 69	15.68	170 28	123 24
2 2 3 4 5 5 6 7 7 8	276		16 55									20.83	226 21	163 72
	225		11 77								2 17	15,79	171 48	121 11
	145		18 11					1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0					120 98	87 56
1	55		19 75									15 36	166 81	120 73
0 0 0	09		18 52					18 36				22.30	212 18	175 28
1	55		14 50									11 27	122 39	200
10 10 10 10 10 10 10 10 10 10 10 10 10 1	224		19 90				8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8					15.62	169 63	122 77
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	124		19 90									89 /	83 40	00 30
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4 20 6 00 6 24 7 50	5 87
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\$0 87 1 20 1 50 0 81 1 20	\$1 12
\$8 05 7 30 7 00 7 00 5 90	\$6 25
\$0.75	.\$4 22
\$5 80 7 00 6 67 18 00	\$7 49
\$2 2 0 0 1 5 0 0 25 0 25	\$1 97
	8 8 8 8 8
\$6 56 50 85 85 82 90 82 90	\$5 82
\$8 80 14 50 19 50 6 68 8 50	\$11 59
	\$26 89
200 100 220 60 60 20	120
70	Averages -

¹ Includes both labor and cost of water.
² Based on yields shown in table and prices given.
³ Average net price paid by the association to the growers in 1929.
⁴ Average association net price to growers, 1919-1931. For 1931 net price estimated by the association at \$3.60 per ewt.
⁵ Average of 17 records.

third table is based on information furnished by the California Lima Bean Growers Association and gives 24 individual costs of production and yields for lima beans on irrigated land and five on nonirrigated land in Ventura County. The income included in these tables is based on the yields given and the average net prices paid to the growers by the association.

An interesting feature of Table 33 is that it gives data for both irrigated and nonirrigated land. Examination of the table will disclose that at the average price paid to the growers by the association for lima beans for the period 1919–1931, the residual income above costs for the irrigated land was \$40.09 and for nonirrigated land was

\$4.78 an acre.

Table 31, relating to lima beans in Orange County, shows in the last column the residual income above costs of production and harvesting, not counting the cost of water. The range is from \$42.38 to \$126.02, averaging \$83.24. The cost of water was a minor factor, ranging from only \$1.67 to \$5.78, averaging \$3.08. A similar column is not included in Table 33 giving the one-year records furnished by the California Lima Bean Growers Association. The difference for the latter between the estimated average cost and the estimated average return in 1929 was \$82.99. The average cost included \$9.42 for irrigation water and its application. While the average residual incomes above other costs than the cost of water shown by the two tables are thus close together, the similarity is not significant because the Ventura County records are for the year 1929 only, the year of recent maximum price, whereas the Orange County records covered a 4-year period in which the average price was much less than that in 1929. The residual incomes which have been computed are only generally indicative of what may be expected. The information available does not justify any extended statistical study.

Although no records of costs of production and yields for sugar beets are available from individual growers, a field agent of the American Beet Sugar Company furnished figures relating to cost of production based on experience at Lompoc, in Santa Barbara County, and the American Beet Sugar Company has furnished composite figures relating to the yield, sugar content, and gross returns in the Chino, Downey, Compton, and other districts of San Bernardino and Los Angeles counties for the years 1930, 1931, and 1932. The latter appear as Table 34. The data regarding cost of production of sugar beets at Lompoc are summarized below. It has been estimated by Mr. J. W. Rooney, superintendent of the American Beet Sugar Company at Ventura, that these costs are about ten per cent higher than in 1932.

SUMMARY OF ANNUAL COSTS OF PRODUCTION OF SUGAR BEETS BASED ON EXPERIENCE NEAR LOMPOC

Item Co	st pe	r acre
Plowing	\$1	60
Replowing	1	60
1/lonting	- 11	50
20 pounds of seed	2	40
Thinning	0	0.0
Cultivating five times	2	50
Irrigation	- 6	50
I'lowing out	1	60
Topping and loading	S	10
Hauling	7	50
Depreciation		70
Total	\$40	00

AVERAGE ANNUAL YIELDS, SUGAR CONTENT, AND GROSS RETURNS PER ACRE FROM SUGAR BEETS IN SEVERAL DISTRICTS IN SAN BERNARDINO AND LOS ANGELES COUNTIES DURING THE PERIOD 1930-1932, AS SHOWN BY A COMPOSITE RECORD OF A NUMBER OF FARMS

Acreage	Average yield	Sugar content,	Average gross return			
	per aere, tons	per eent	Per ton	Per acre		
СНІГ	NO DISTRICT					
756	13.67	15.54	\$7 78	\$106 35		
1,450 1,336	11.30 13.21	12.93 16.63	6 47 6 57	73 11 86 79		
1,181	12.73	15.03	\$6 94	\$88 35		
сомі	PTON DISTRIC	т				
476	12.84	15.73	\$7 87	\$101 05		
735 453	9.22 14.14	$ \begin{array}{c c} 14,10 \\ 16.40 \end{array} $	7 05 6 56	65 00 92 76		
555	12.07	15.41	\$7 16	\$86 42		
WNEY, SUGAR	, WINTERBUR	G DISTRICTS				
398	12.86	17.63	\$8 81	\$113 30		
648 2,699	10.68 14.33	12.98 16.36	6 49 6 54	69 31 93 72		
1,248	12.62	15.66	\$7 28	\$ 91 87		
	756 1,450 1,336 1,181 COMI 476 735 453 555 WNEY, SUGAR 398 648 2,699	Acreage yield per acre, tons	Aereage yield per aere, tons content, per eent	Aereage		

It will be seen from the above table and from the summary of eosts of production at Lompoc that the residual return to the grower from sugar beets averaged close to \$50 an acre during the years 1930. 1931, and 1932. Some growers look upon sugar beets as one of the most profitable of the field crops and it is recognized as being excellent in rotation with other crops, particularly beans and alfalfa. Rotation is said to be the best known control for nematodes and wireworms which attack this crop.

PRESENT COSTS OF IRRIGATION WATER

While Chapter V of this report is devoted primarily to presentation of data regarding amounts growers now pay for irrigation water for the different crops and in the different parts of the southern California coastal plain, it seems desirable to summarize briefly in this chapter data regarding the annual cost of water for deciduous fruits and field and truck crops.

The following average annual costs of water for irrigation in areas in which the crops listed in the above summary are predominant are taken from tables in Chapter V of this report:

Location	Predominant crop (From Table 37)	Aver anna cost wat per a	of er
Gardena	Truck	\$18	
Moorpark	Deciduous fruits	12	10
	(From Table 38)		
	MiscellaneousAlfalfa and miscellaneous		56 76
	Deciduous		23
Ventura	Miscellaneous	19	75
	Beans		49 70
	(From Table 39)		
Costa Mesa	Field and truck	22	56
	(From Table 43)		
Somis	Lima beans\$10 73 to	16	64

Tables 31 and 32 in the present chapter also give information regarding present irrigation costs for these crops. For the apricot records from Riverside County show an average range is from \$10 to \$19.52. For the lima bean records from Orange County the range is from \$1.71 to \$5.78.

Bulletin 36 of the Division of Water Resources furnishes additional information regarding annual water costs for deciduous fruits and field and truck crops in the southern coastal plain, the figures being as of 1929. The following costs are taken from this bulletin and are for companies or districts in which the crops irrigated are mainly those considered in the present chapter, interest on value of capital stock or on retired bonds not being included.

Location	Predomi	nant crop	Water cost
Ontario Ventura San Jacinto Pomona West Covina Ontario Whittier Riverside Monrovia	Deciduous	tin 36, Table 5, p. 31) fruits fruits and miscellaneous fruits, alfalfa and miscellaneous fruits and miscellaneous fruits and miscellaneous fruits and miscellaneous fruits and alfalfa fruits and miscellaneous fruits and miscellaneous fruits and miscellaneous fruits and miscellaneous fruits	9 07 23 65 14 43 22 50 12 39 19 83 19 83 11 13 13 42
	(From Bullet	in 36, Table 28, p. 97)	
Costa Mesa	Deciduous	fruits and miscellaneous fruits, field, and truck fruits and miscellaneous \$8.11	32 83 18 05

CHAPTER V

CHARGES FOR AND USE OF IRRIGATION WATER IN THE SOUTHERN CALIFORNIA COASTAL PLAIN

COSTS AS SHOWN BY COST-OF-PRODUCTION RECORDS

Information on charges for irrigation water in southern California has been secured from individual farm records, of which more than a thousand, covering 2- to 6-year periods, have been available, and from agencies furnishing water to the farmers. Irrigation districts, mutual water companies, and public utilities come under the latter grouping. Water costs include the following: all water tolls or assessments, or both, if secured from a water agency; energy charges, interest, and depreciation in equipment used to deliver water to the property, if privately owned. Nothing is included in these charges for farm distributing systems.

The farm records for citrus were collected on a quota basis, and with the possible exception of Orange County, where the proportion of Agricultural Extension Service is relatively large, the number of records tends to be proportional to the acreage in the district. For this reason, total figures should be a fairly good cross section of the water costs in the entire southern California coastal plain. Since the majority of the growers receive water from sources other than private, allowances for interest and depreciation are usually included in the

costs given.

Table 35 gives the distribution, by areas and by regions, of annual water costs per acre for 652 orange groves. These water costs range from \$1.86 an acre to \$95.25, with a mean of \$28.12. The modal figure is a little over \$20. Some districts are very much better situated from a water-cost point of view than are others, so that in analyzing the figures it is more important to note differences in costs between areas than to lay stress on a regional mode. Orange area 10 and Lemon area 4 embrace a number of districts which have a rather wide range of water costs. Costs in these districts are therefore shown separately in columns A, B, C, and D, as well as being combined in column E.

Table 36 gives the distribution of water costs for lemons. Since lemons are not grown as widely as oranges, fewer areas are reported. Two hundred forty seven records are represented. The spread in cost is very similar to that in oranges, the mean being slightly higher, viz: \$35.97. Area L4 is substantially the same as Orange area 10.

Plate II presents curves of the data given in tables 35 and 36. The number and percentage of total groves are plotted along the vertical axis; water costs in dollars per acre are plotted horizontally. Two-thirds of the orange groves have an annual water cost over \$18 an acre, while two-thirds of the lemon groves have water costs over \$24 an acre.

FREQUENCY DISTRIBUTION OF AVERAGE ANNUAL COSTS OF IRRIGATION WATER PER ACRE TO ORANGE GROWERS IN THE COASTAL PLAIN OF SOUTHERN CALI-FORNIA, 1926-1931. AS SHOWN BY 652 CALIFORNIA CITRUS LEAGUE AND AGRICULTURAL EXTENSION SERVICE RECORDS OF COSTS OF PRODUCTION

									Area									
Range in costs, dollars per acre	1				=	C					102							
	1	2	3	4	5	6	ĩ	8	9	Α .	В	C	D	Е	11	12	15	_
)- 2																1		
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- 8		6	1		2 3								2	2				
-10	2	2	4	1	4	1	7	1										
-12			8	3	5	3	3	2					2	2				
-14		1	9	2	6	5	5	4					2	2	1	3		
-16		3	11	1	5	5	- 6	4					2	2		1	1	
-18		6	7		5	8 3	4				4		2 2 2 3 3	2 2 7 7		3		
-20 -22	- 1	3 2	10 1	4	8 8	8	11 4	1 4	3		6	6	1	13	3 4	4		1
2-24		ا ئد	2	1	5	6	7		10		5	2	2	9	9	5		
1-26	3		5	2		ĭ	i		2		9	5	2	15	2 2	8	3	1
-28		2	1	1	1	1	5	1	1		5		4	9		4		ı
3-30	-1		2 I	4	1	2	6	1	1		4	1	1	- 6	2	2	2	П
)-32	1			1		1	6	2	1		2		1	3		1		L
-34			I	3		1	5				2	4	2	8 7	2	5		П
-36			1 2				4	1	1		2 2 3 1	4		1 7	2 2 2 3	1	2	1
-38		2 2	2	1			4			1	5	2	2	8	2	i		
3–40 3–42			1			1	4	2		1	3	4		8	2	1	2	
-41	2	1	1			1	2	-		6	4	-3		10	ĩ		-	1
-16.						1	4				5			5				
5-48	1								1		4		1	5	2 2			
3-50		1								3				3		1		
)-52											3 2 2 3	3		6				
-54					1					1	2			3	3			
-56										2	2	1	$\frac{2}{1}$	6 5	1			L
5-58 8-60	1										2	1	1	2	2			L
0-62		2								1	-	1	2	4	ī			
2-64										1			2	5				
-66										4	1			5	1			1
6-68																		-
3-70											;-		2 3	2				
)-72		1								~ ~ ~ ~	1		3	4				
2-74											3		1	1 4	1			
1–76. 5–78.											I		1	1				
8-80											î			i				L
)-82													1	î				
2-81													1	1	1			
-86																		-
3-88																		-
8-90													1	1	2			
0-92											1			1				
2-94															1			-
1. 90						~												
Totals.	12	35	67	24	54	41	88	23	20	20	87	34	44	185	44	49	10	

¹ Lower limit inclusive.

² A. Corona; B. Claremont, Upland, Etiwanda; C. Pomona, Ontario, Cueamonga; D. Glendora, Azusa, Duarte, Monrovia; E. total, area 10.

FREQUENCY DISTRIBUTION OF AVERAGE ANNUAL COSTS OF IRRIGATION WATER PER ACRE TO LEMON GROWERS IN THE COASTAL PLAIN OF SOUTHERN CALIFORNIA, 1926-1931. AS SHOWN BY 247 CALIFORNIA CITRUS LEAGUE AND AGRICULTURAL EXTENSION SERVICE RECORDS OF COSTS OF PRODUCTION

						Area					
Range in costs, dollars per acre ¹	1	2	3	42					-	_	(T)
	1	2	ئ 	A	В	С	D	Е	5	7	Tota
6- S		1	9				1	1			
S-10		$\hat{2}$	2 2					1			
0-12			5							1	
2-14		1	4								
4-16			8				1	1		1	
5-18			5				1	1			
3-20		2	7		2			2		1	
1-22	1		6		2 2 2 6			2 2 3 2 6	1		
-24	2	1 2	9		2		1	3	1	1	
-26 -28	1	3 2	15		2			2	2	1	
-28 -30	i	2	9		1			0 1			
-32			9		1			1	1		
-34	2	1	2 4		$\frac{1}{2}$			2	2		
-36	ī	i	1		-					1	
-38	î	1			1			1		1	
40	3		1	1	5			6			
-12			î		4			4	1		
-14	3				2			2	2		
-16	3				5			2 5	2 2 1		
-48			1		1			1	1		
-50				5	2			7		1	
-52	1			1	3			4			
-54		~		1	1			2 8	1		
-56				3	1	3	1	8			
-58	1			1	3		1	5			
-60		1			2	1		3	1		
-62 -64					4	1	2	7	1		
-66				1	$\frac{1}{2}$		1	2 3	1		
-6S				1	-			0	1		
-70							i	1			
-72					1		i	2			
-74					î		1	1			
-76					i		3	4			
-78					1			1			
-80											
-82							1	1			
-84					1		2	3			
-86											
-88											
-90							1	1			
-92					1		1	2			
-94									1		
Totals	19	15	90	13	61	5	19	98	18	7	2

¹ Lower Hmit inclusive. ² A, Corona; B, Claremont, Upland. Etiwanda; C, Pomona, Ontario, Cucamonga; D, Glendora, Azusa, Duarte, Monrovia; E, total, area 4.

Water costs for grapefruit, as shown by 34 Citrus League records, fall in line with water costs for lemons. The average water cost for grapefruit was \$37.73, the range, \$15.14 to \$93.31.

Information available on individual-farm water costs for crops

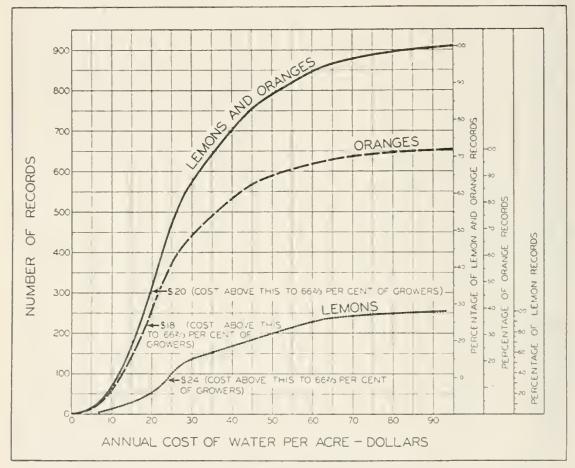
other than eitrus is not as extensive as that presented above.

The Agricultural Extension Service in Orange County has been collecting cost data on avocado production since 1930. Seventeen 1- to 3-year records (1930–1932) show a range in annual water costs from \$8.50 to \$100, with an average of \$46.07 (Table 41).

For walnuts, eighty-four 2- to 5-year records for San Bernardino. Orange, Los Angeles, and Ventura counties are available from Table D in the appendix. For apricots, which are fairly representative of deciduous fruits, nine 2- to 4-year records, mainly from Hemet and vicinity, have been obtained from the farm advisor of Riverside County. Water costs for these ranged from \$10 to \$19.50 an acre. averaging \$15.65.

Ten 2- to 4-year records for lima beans were supplied by the farm adviser of Orange County, and 94 one-year records were collected over the 4-year period 1928 to 1931 by Zone Water Companies 1 and 2 in Ventura County. Most of the lima bean records from Orange County have come from the Santa Ana district, where the usual water cost is about \$3 an acre.

PLATE II



Cumulative frequency curves of the cost of irrigation water to growers of lemons and oranges in the coastal plain of southern California as shown by cost-of-production records from the California Citrus League and Agricultural Extension Service of the University of California.

Average annual water costs per aere in the 84 walnut orchards mentioned above have ranged from \$2.17 to \$29.19, averaging \$12.75. The spread is not as great as in the case of citrus. Walnuts, as a rule, occupy the deep soils of the alluvial areas where water can usually be secured more cheaply than on hill land.

The mean water costs per acre for walnuts for each of the counties listed in Table D in the appendix were as follows: Orange County, \$11.78; Los Angeles County, \$12.93; San Bernardino County, \$12.42; and Ventura County, \$13.65. It is seen that these county averages fall very close together.

¹ The details for these records are presented in Table 43.

COSTS AS OBTAINED FROM COMPANIES AND IRRIGATION DISTRICTS

The records from which the data presented above have been obtained do not indicate whether the water supply used was secured from an individual pumping plant or was purchased from some water agency. On the other hand, the cost-of-water records secured from agencies supplying water usually do not apply to single crops. The records for such agencies given below, however, cover the principal crops in the areas to which the present report applies.

Public utilities.—In the case of the public utility water companies water is delivered at a definite rate, which has been approved by the State Railroad Commission. Farmers receiving water from such agency can report rather definitely on what irrigation water is costing them.

Table 37 presents information on the cost of irrigation water under public utilities. Not all of the utilities had filed their annual report with the Railroad Commission at the time the data were compiled, so the average amount of water used per acre in 1932 is not definitely known. However, it has been possible to determine representative average costs per acre by applying the rates for 1932, which have been obtained from the Railroad Commission, to the average use in the years 1925–1929, as given in Bulletin 36 of the Division of Water Resources.

TABLE 37

AVERAGE ANNUAL COSTS OF IRRIGATION WATER UNDER 8 PUBLIC UTILITIES IN THE SOUTHERN CALIFORNIA COASTAL PLAIN, UNDER 1932 RATES:

Location	Approxi- mate aereage, 1931	Water supply	Principal crop or type of develop- ment	Average amount of water delivered, 1925-1929, acre-feet per acre ²	Average water charge per acre-foot, 1932	Average cost of water per acre
San Diego County— National City Los Angeles County—	5,000	Surface	Citrus	0 9	\$34 85	\$ 31 35
Gardena		Wells	Truck	2 2	8 40	18 48
Alhambra	175	Wells	Suburban	1 6	34 85	55 76
Whittier	2,000	Wells	Citrus.	1 4	24 20	33 88
Ventura County—						
Oxnard	1,200	Surface	Walnuts	1 4	5 04	7 05
Santa Paula	5,700	Wells and surface.	Citrus and walnuts.	1 7	5 54	9 42
Piru	280	Wells	Citrus	2 3	3 63	8 35
Moorpark	685	Surface	Deciduous		12 10	12 10

¹ The rates for 1932 were applied to the average amount of water delivered per acre during the period 1925-1929. Amounts of water delivered during 1932 were not available at the time this table was prepared.

² From Bulletin 36, "Cost of Irrigation Water in California," Division of Water Resources.

Mutual water companies.—A mutual water company is a private water company organized solely for the purpose of supplying water to its stockholders or members at cost. Charges for water may be in the form of water tolls or assessments. It is often difficult to state the actual cost of water under this type of organization owing to inability to secure information on the company's investment. In Bulletin 36 of the Division of Water Resources the market value of stock was used as a basis for determining the investment. Recently

¹ For a discussion of factors in cost of water under public utilities see State of California, Department of Public Works, Bulletin 36, pp. 20-21.

03

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\$100 2

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 $\widehat{\Xi}$

San Diego County

Escondido

Surface

5,000

(12)

 Ξ

50 03

000

252

52

67

7 95 None None

6 5

888 2000

Surface and wells...
Wells...

Citrus....

8,000 2,550 3,000

Anaheim. Yorba Linda

La Habra

Orange County-

4 76 21 56 22 32 25 32 26 31 6 25 31 13 47 13 47 14 19 31 20

2 19 None 25 32 25 31 21 80 9 25 1 75 6 56 6 56

30

1 51 19 60 None None 24 20 None 7 56 15 13

34 34 35 35 35 36 37 38 38

110 40 90 00 270 00 233 33 500 00 200 00 150 00

10 00 50 00 73 60 150 00 116 66 50 00 50 00 50 00

 $\begin{array}{c} 1 & 00 \\ 50 & 00 \\ 10 & 00 \\ 100 & 00 \\ 100 & 00 \\ 100 & 00 \\ 20 & 00 \\ 50 & 00 \\ \end{array}$

Miscellaneous and citrus. Citrus Citrus

Citrus.

Miscellaneous

Citrus.

1,792 5,000 2,500 1,500 2,500 540

Pomona

Glendora Duarte

Pomona .

Compton

Rivera . Los Angeles CountySurface and wells. Surface and wells.

Citrus

Walnuts

1,200 2,100 2,000 2,100

North Whittier

Duarte

West Covina

San Dimas...

Citrus

Wells

Wells. Surface and wells.

Surface Wells 72 6.1

57

08 00 20 20

31 0

98

15

70 gs

888

200

Surface and wells.... Surface and wells....

Alfalfa and miscellancous,

Citrus

1,400 6,391 7,509

Corona....Riverside.....

Riverside.

Riverside County

TABLE 38

AVERAGE ANNUAL COSTS OF IRRIGATION WATER UNDER 36 MUTUAL WATER COMPANIES IN THE SOUTHERN CALIFORNIA COASTAL PLAIN, 1932 or water per acre charge ment per Average acre last 8 years assess-Per aere Water tolls acre-foot in 1932, acre-foot delivered Average of water per acre Market value of stock per acre in 1932 Par value of stock per aere Capital stock Par value of stock per share Average of shares per aere Water supply Principal crop or development type of Approxiserved in 1932 mate Location

23 15 15 00 14 50 14 50 10 20 10 20	19 75 110 19 13 70 13 50 10 26 10 7 26
23 45 15 00 15 00 14 50 9 56 9 21 9 21 8 95 10 19 None 17 00 17 00	1 60 None None 3 36 1 56
34 02 15 00 8 23 15 20	18 15 10 49 13 70 13 50 29 81 5 70
None None None None 9 0 7 None 15 12 10 10 None 15 12 None 15 10 None 15 10 None 15 10 None 15 10 None 15 10 None 16 10 None 17 10 None 18 None 18 No	18 15 7 49 10 15 6 75 11 37 3 00
2 1 2 1 3 1 3 3 3 3 5 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	1.35 2.2.3 2.3.8 1.9
112 50 132 00 200 00 35 00 103 50 330 00 200 00 100 00 60 00 60 00	250 00 200 00 175 00 60 00
150 00 1100 00 1100 00 100 00 100 00 100 00 100 00 1100 00 1100 00 1120 00 1130 00	10 00 100 00 100 00 100 00 20 00 20 00
100 00 100 00 100 00 100 00 100 00 100 00 100 00 100 00 100 00 100 00	100 00 100 00 100 00 100 00 100 00 100 00
1.1 1.10 2.00 1.10 1.38 1.13 1.15 1.15	101212
Surface Surface Surface Surface and wells Surface and wells Surface and wells Surface and wells Wells Wells Wells Wells Wells Surface and wells	Wells Wells Surface and wells Wells Wells
Citrus	Miscelfancous. Beans Beans. Citrus Citrus Walnuts.
1,000 1,363 1,363 806 11,690 1,690 1,150 1,150 1,150 1,150 1,150	1,077 3,515 1,905 1,329 500 1,800
San Bernardino County— Rediands Rediands Rediands Rediands Rediands Gontana Finito Etiwanda Ontario Ontario Cocamonga	Ventura County Ventura Somis Somis Souns Santa Paula Santa Paula Satta Paula

Average charge for water per acre (column 13) equals column 11 plus column 12.
 No figure available for 1932. Used 1929 figure.
 Rate during major part of irrigation season. Water charge for minimum use \$10.00 per acre.

No assessments since 1926.

This company receives revenue from an outside source. Water tell covers operating expenses only,

7 No assessment in 1932.

No assessment 1930-1932.

* Average fast six years to users below the company canal.

* Average fast six years to users below the company canal.

* 1932 was the first year in which water tolls were levied.

* Theludes all operating expense, maintenance, repair, bond interest, sinking fund and d_preciation.

AVERAGE ANNUAL COSTS OF IRRIGATION WATER UNDER 11 IRRIGATION DISTRICTS IN THE SOUTHERN CALIFORNIA COASTAL PLAIN, 1931 TABLE 39

Sosts	Per acre		37 52			27 01	22 56	45 96 14 59
ater	ď.	,						
Average water costs	For 1 acre- foot only	\$38 92	317	37 43	43 25	27 04	26 85 19 38	12.55
Average total	assessment per acre	\$12.39	19 66			12 31	13 52	18 20 10 00
Average	assessment rate per \$100 valuation	\$2 60	4 20 25 25 25 25 25 25 25 25 25 25 25 25 25	900		7 80	1 40	1 75 1 00
Average	water toll per acre-foot		21 78				13 33	69 40 2 55
Average amount of	water delivered, acrefect per acre	63	0 82	16 0 0 0 51 C		1.00	06.1	0 + 8 + 8
Principal crop or	type of devel- opment	Citrus	Suburban	Avocado	Suburban	Avocado and citrus	Suburban Field and truck	Suburban
	Water supply	Surface and wells	Surface and wells	Sarface	Wells	Surface	Wells Wells	Surface and wells
Approximate	acreage irrigated, 1931	1,220	3,000	2,000	110	0,100	900	800
	Location	San Diego County— La Mesa	Lakeside Santa Fe	Encinitas	San Ysidro	V ISCO	Orange County— Costa Mesa Costa Mesa	Los Angeles County— La Canada Rivera

¹ Information from Bulletin 21-C, "Irrigation districts in California, 1932," Division of Water Resources.

sales of water stock have been few, so the selling price can not well be used. It is assumed in this report that over the 8-year period covered, assessments and water tolls have been sufficient to take care of maintenance, operation, and depreciation, plus interest and redemption charges on outstanding obligations, this amount then representing the cost of water to the farmers. A number of mutual water companies were circularized for recent information on water costs. The data obtained in conjunction with the information in Bulletin 36 of the Division of Water Resources, have been used in preparing Table 38.

Irrigation districts.—An irrigation district is a public corporation organized under State laws empowering it to issue bonds and levy and collect assessments for the purpose of providing a water supply to irrigate lands within its boundaries. The information on water costs in irrigation districts, presented in Table 39, has been taken from Bulletin 21-C of the Division of Water Resources.

Table 37: Public utility water companies. The percentage of irrigated acreage in southern California served by this type of organization is relatively small. Average annual water costs, for the companies listed, varied from seven dollars per acre to approximately \$56, while average amounts of water delivered varied from 0.9 to 2.3 acre-

feet per aere.

Table 38: Mutual water companies. Acreage served, principal crop, source of water supply, number of shares of water company stock per acre, par value and market value of stock per acre, average amount of water delivered, and average annual assessments and tolls have been listed wherever the information was available. Wide ranges in cost and use of water occur. While both the par value and market values of the stock are given, interest on the stock has not been included.

Table 39: Irrigation districts. All of the eleven districts are relatively small. While citrus and avocados are the principal crops, some of the districts serve suburban areas. Water costs vary from \$14.59 per acre at Rivera to approximately \$46 at La Canada.

SEGREGATION OF COSTS OF PRODUCING AND DISTRIBUTING WATER UNDER TYPICAL COMPANIES

Some question was raised during the investigation regarding the items that go to make up the cost of producing and distributing water under typical water companies in southern California. Table 39-A presents such information for seven mutual water companies taken from their annual report. In most of the cases the figures are averages of the costs in 1931 and 1932. Those for the last two companies are averages for the four years 1928 to 1931.

TABLE 39-A

TOTAL ANNUAL COST OF PRODUCING AND DISTRIBUTING WATER UNDER SEVEN MUTUAL WATER COMPANIES IN SOUTHERN CALIFORNIA SEGREGATED BY MAJOR ITEMS OF EXPENSE

	Sun Antonio	tonio	Fontan	Fontana Union	Clendora	(Tendora onsolidated	Rive	Riverside	Escondid	Escondido Mutual		Zone water	Zone water companies	
Cost item	Water Company	ompany	Water C	Water Company	Mutuall	Mutual Irrigating Company	Water (Water Company	Water C	Water Company	N	No. 1	Z	No. 2
	Average 1931-1932	Per cent of total	Average 1931-1932	Per cent of total	1932	Per cent of total	1932	Per cent of total	1932	Per cent of total	Average 1928-1931	Per cent of total	Average 1928-1931	Per cent of total
Production	\$38,038 15	43.0	43 0 \$65,386 18	33 6	33 6 \$36,194 41	13 8	13 8 \$30,788 31	36.4	36.4 \$6,126 55	15 2	15 2 \$18,511 75	73.1	73.1 \$13,402.46	71.9
Distribution	9,069 30	10 3	10 3 19,685 22	1 01	10 1 11,222 24	13 6	13 6 18,806 26	22.3	22.3 11,837 72	29.4		99 2	1 794 25	95 9
expense end general	13,482 76	15 2	15 2 17,386 38	8.9	10,281 94	12.4	12 4 21,769 58	25 8	3,629 32	0 6	81 000° 6	6.03		2
Taxes Insurance Interest	5,827 28 1,144 08 20,900 32	6.5 1.3 23.6	5,457 60 2,248 90 81,512 21	45.2 45.2 45.2	3,926 97 21,071 00	1.8	6,293 19 1,637 96 5,192 85	7.5	3,618 20 289 23 11,700 00	9.1	625 03 190 91 86 31	21 0 0 70 8 86	157 76 83 58	0.5

COSTS OF WATER IN RELATION TO QUANTITIES APPLIED

While in the present study the value and cost of water for irrigation are considered mainly on an acreage rather than a water-quantity basis, tables 37, 38, and 39 relating to costs under public utilities, mutual water companies, and irrigation districts, include available data regarding water costs per acre-foot of water applied. The information regarding the amounts of water applied used in computing the costs on an acre-foot basis appear in the tables. Some additional information of the same nature has been obtained from the Agricultural Extension Service cost-of-production records from Orange County relating to oranges, lemons, avocados, walnuts, and lima beans; from Los Angeles County relating to walnuts; and from Zone Water Companies 1 and 2 in Ventura County for lima beans. This additional information is presented in tables 40, 41, 42, and 43.

Table 40, in addition to the information on use and cost of water, includes yields, since it is thought that there may be some interest in this information. It should be kept in mind, however, that while the figures represent, with a fair degree of accuracy, the quantities of water delivered, they do not give the amount of water lost through run-off or deep percolation, and therefore do not show what was used

by the crops.

Average annual use of water on the avocado orchards listed in Table 41 varied from 8.9 to 34.5 inches. The costs per acre-foot

varied from about \$8.30 to \$44.

Ninety-five yearly records are represented in Table 42. Average annual depth of irrigation varies from 6.3 to 55.7 inches, while costs

per acre-foot varied from 75 cents to \$26.

The lima bean records given in Table 43 are from the Las Posas Valley in Ventura County. The water used is served from wells. Variations in average annual depths of irrigation range from 4.6 to 54.2 inches. The water cost per acre-foot was uniform for each water company for the year. The cost per acre-foot in Zone Water Company

No. 1 was \$7.50; in Zone Water Company No. 2, \$10.00.

A large amount of information has been gathered from time to time regarding the quantities of irrigation water applied in various parts of the southern California coastal plain. More recently the Division of Irrigation Investigations and Practice of the University of California has been making more precise measurements of the net amounts required, these studies mostly having been conducted by Professor S. H. Beckett. The studies in San Diego County were made in cooperation with Harry F. Blaney and Colin A. Taylor of the Irrigation Division. Bureau of Agricultural Engineering, United States Department of Agriculture. Subsequent to this study Professor Beckett extended the work to Orange, San Bernardino, and Riverside counties.

¹The information from various sources is summarized in Bulletln 6 of the Division of Engineering and Irrigation (now Division of Water Resources) entitled "Irrigation requirements of California lands," 1928. See chiefly Table 8, pp. 117-131.
² University of California, Agricultural Experiment Station Bulletin 489, "Irrigation water requirement studies of citrus and avocado trees in San Diego County, California, 1926 and 1927," 1930.

AVERAGE DEPTHS OF WATER APPLIED, AVERAGE COSTS OF WATER PER ACRE AND PER ACRE-FOOT, AND AVERAGE YIELDS FOR 45 ORANGE ORCHARDS AND 12 LEMON ORCHARDS IN ORANGE COUNTY, 1927 TO 1932 TABLE 40

Data from the Agricultural Extension Service cost-of-production records

		1	1932		131 162 163 163 163 163 163 164 165 165 165 165 165 165 165 165 165 165
	r acre		1931		163 172 172 168 168 168 169 111 112 112 113 169 169 169 173 183 183 183 183 183 183 183 183 183 18
	od saxog		1930		100 100 100 100 100 100 100 100 100 100
	Yield, packed boves per acre		1929		129 129 129 129 129 129 129 129 129 129
	Yield.		1928		108 108 108 108 108 108 108 109 109 109 109 109 109 109 109 109 109
			1927		1306 1306 1306 1307 1500 1500 1500 1500 1500 1500 1500 15
			1932		\$10 014 6 537 10 76 8 56 9 85 10 02 10 036 10 036 10 036 10 036 10 036 11 12 12 12 12 12 12 12 12 12 12 12 12 1
			1931		\$65
		-foot	1930		6 6 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8
		Per acre-foo	1929		\$65 \$65 \$65 \$65 \$65 \$65 \$65 \$65
			1928		9825448883296666666666666666666666666666666666
	Cost of water		1927		\$\$6 5 5 6 5 6 6 6 6 6 6 6 6 6 6 6 6 6 6
			1932	ORANGES	\$10 54 7 017 7 018 8 29 17 62 17 62 114 20 6 23 6 23 6 23 6 29 6 23 6 23 6 23 6 23 6 23 6 23 6 23 7 7 79 112 69 112 69 115 58 115 58 114 93 114 93 114 93
			1931	ORA	14 87 83 89 90 83 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8
		acre	1930		\$\\ \frac{65}{8}\$ \\ \f
		Per a	1929		\$\\ \frac{8}{2} \\ \frac{8}{2} \\ \frac{1}{2} \\ \f
			1928		\$\$ 56 \$\$
			1927		8 6 0 2 0 2 0 2 0 2 0 2 0 2 0 2 0 2 0 2 0
			1932		201112 6 201112 6 201112 6 20112 7 2012 7 2013 8 2013 2 2013 8 2014 8 2015 2 2016 8 2016 8 2017 7 2018 8 2018 8 20
	-	, inches	1931		13. 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
		riganon	1930		22 0 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
		ptn of ir	1929		20
		Average depth of irrigation, inches	1928		62 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
		AV.	1927		20 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
		le crial			2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2

242 202 202 247 160 160 160 176 176 176 176	256
191 280 281 282 282 282 282 282 282 282 282 282	223
76 92 211 211 133 113 113 115 115 115 115 115 115 1	152
230 220 220 240 240 255 321 760 260 260 260 260 260 260 260 260 260 2	253
108 150 172 173 173 32 116 250 104 104 219	1117
138 130 347 158 158	188
10 05 4 86 6 73 6 73 11 10 11 10 11 00 11 00 11 00 11 00 11 00 12 00 13 00 14 86 15 00 16 00 17 00 18 00 18 00 19 00 10 00	\$9 04
5 743 6 03 6 03 9 58 9 22 11 10 8 22 11 10 10 42 11 35 8 24 11 35 8 24 11 35 8 24 11 35 8 24 8 24 8 25 8 27 8 27 8 27 8 27 8 27 8 27 8 27 8 27	\$7 64
18 3 4 06 6 56 6 56 10 23 3 24 64 23 13 5 24 64 7 7 81 7 7 81 7 7 80	\$7 81
9 1 9 1 9 1 9 1 9 1 9 1 9 1 9 1 9 1 9 1	\$8 17
28 73 35 55 13 35 13 15 15 15 15 15 15 15 15 15 15 15 15 15	\$8 86
6 8 8 2 2 9 9 5 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	\$6 74
10 05 111 55 111 55 111 55 5 60 5 60 117 76 23 16 23 16 16 74 119 86 12 86 12 86 17 08	\$16.28
11 05 8 75 12 12 12 12 19 08 33 09 10 12 17 69 11 19 11 19 11 19	\$16 28
7 4 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	\$15 86
9 88 115 55 117 86 117	15 15
9 10 6 01 6 01 6 04 6 04 6 04 6 04 113 91 11 74 11 74	12 90 \$
10 05 9 51 12 41 1 15 11 19 12 28 67	\$10 56 \$12
200 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	21.95
4 8 3 2 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	
28 1 2 3 3 4 4 3 3 5 5 5 5 5 5 5 5 5 5 5 5 5 5	20.64 19.00 19.84
121 - 182 - 183 -	20.64
201014101000 201014101000 201014101000 201014101000	18 70
26.5 27.5 27.5 20.2 20.2 33.4 15.6	17.20
2.5.2.3.3.3.3.2.3.3.2.3.3.3.3.3.3.3.3.3.	Average.

	16.6	007	199	7	149	91	37	151	143	0.1	101	911	132	113
	180	100	316	83	323	131	99	121	255	8 9 9	1 1		1 9 6 9 1	185
		1 1 1 1 1	263	80	2	85	72	130	4	1 1	2 2 5 4 2	1 1 1		118
		t h	212	- ;		110		1	1 1 1 2 2	1 1 1	1 1 1 1 1	6 5 0 0	1 1 1 1 1 1	144
	816 04	£0 012	21 - 26	11 36	12 65	7 28	30 29		20 54	13 20	10 54	28 16	1 1 1 1 1 1	39 \$17 51
	610	210	62 63	9	15	00	31		26 53	13	6	25 25	10	\$17
	610	014	3	2	15	9	62	15	19 14	12	90 8	13 25	96 2	\$17.86
	690	075	19	26	13	9	63	-		-	8 1	1 1 1	1	\$15 72
	61100	+10	00	Ξ	Ξ	06 9	18	_	0 0 0 0	1 1	1	1	-	\$10 72
		1 0 1	\$52		36	7 07	57	1		1	1	1 1	1	\$34 68
EMONS	0.0	ナリタ	C.1	Ξ	23	C	18		21 05	6	25	29	1	91 \$22 12 \$19 64
_	0 0	17	30	Ξ	27	13	20		26	7	36	26		\$22 12
	2.0	? ?	97	Ξ	27	20	20	26	21 05	10				\$17.91
	000	27.0	13	Ξ	255	-	16	10	26 32		9		1	88 \$17 49 \$17
		NI PO	10	1	30	12 07	=	573			1			\$13 88
			\$25 00		29.8	8 70	16 50	33					1 1	\$16 71 \$13
	į.	1 (13	5	2.5	15.0	1~		12.3	00	29.2	12 7		7 14.72
		_	19	133	21	18 2	00		+	15	7	=	25	9 16 47
		0 7 1	10 2	13	9 06	0 0	300	20.0	13 5	0 01	32.7	13.6	21.1	26 15 39
	:	2	=		9.1	000	_	26	25.8				1 1	15
	1	/	50	9	0.06	0 0 0	0	0 250		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		1	1 1	11 07 16 26
			27			- 5			1 1 1	E 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	1	1 1 2 4 4		11 0

Average.

The average given is that for the entire area in oranges and lemons on each farm covered by the records.

Note: Seasonal minfallfor Santa Ana during the period 1926-1931 was as follows in inches: 1926-27, 18.71; 1927-28, 13.02; 1928-29, 10.18; 1929-30, 14.58; 1930-31, 12.07.

AVERAGE DEPTHS OF WATER APPLIED AND AVERAGE COSTS OF WATER PER ACRE AND PER ACRE-FOOT FOR 17 AVOCADO ORCHARDS IN ORANGE COUNTY, 1930 TO 1932

Data from the Agricultural Extension Service cost-of-production records

	Ave	rage depth	of			Cost of	water		
Serial No.1		ation, inch			Per aere		P	er aere-foo	t
	1930	1931	1932	1930	1931	1932	1930	1931	1932
9			10 9			\$37 13			\$40.88
9		21.3	18.7		\$66 48	68 62		\$37 45	44 04
3	20.0	18.6	14.9	\$41 61	49 02	47 30	\$24 97	32 68 44 18	38 09 33 52
5	34 5	$\begin{array}{c} 8 & 9 \\ 34 & 5 \end{array}$	10 9 32 4	37 87	32 77 38 40	30 45 28 00	13 17	13 35	10 37
1	26 7	27 0	14.7	54 31	77 68	33 44	24 41	34 52	27 30
4	15.9	10.5	15.9	13 6S	8 50	12 27	10 32	9 71	9 26
2		22 5	18 4		45 10	12 76		24 05	8 32
2	17.0	21.6	18.8	20 71	27 00	33 33	14 62	15 00	21 27
3		34.4 30.3	21.6		100 00 80 66	61 59		34 88 31 94	34 22
14			9 7		00 00	21 05		31 34	26 04
15		13.5	22.8		35 25	58 50		31 33	30 79
16	9 6			48 00			60 00		
6		19-3	10 9	30 44	33 83	16 30		21 03	17 94
8		34.3	28.4		93 48	73 80		32 70	31 18
17		13.2	13 2		38 96	35 22		35 42	32 02
Average	20.6	22.1	17.5	\$ 36 12	\$59 71	\$37 98	\$24 58	\$28 44	\$27 02

¹ Cost and yield data for orehards numbered 1 to 8 are given in Table 21, p. 59.
² The average given is that for the entire area in avocados on each farm covered by the records.

AVERAGE DEPTHS OF WATER APPLIED AND AVERAGE COSTS OF WATER PER ACRE AND PER ACRE-FOOT FOR 41 WALNUT ORCHARDS IN AREAS W-1 AND W-2, 1929 TO 1932

Data from the Agricultural Extension Service cost-of-production records

		Average	depth of				Costo	f water		
Serial No.		irrigation	n, inches2			Per aere		Pe	raere-foo	ot
	1929	1930	1931	1932	1929	1930	1931	1929	1930	1931
				AREA \	W-11					
1		20 8 20 0 15.6 28 8 21 2 14 0 18.2 15.0 19 2 38 3 22.8 17 9 43.9 19.9 37.6 20 4 38.0 26.4	20.1 19.8 13.3 33.2 22.2 14.4 9.4 17.2 18.0 33.3 33.3 15.5 26.0 16.5 23.5 15.7 57.5 11.3	21.3 15.9 28.1 9.8 12.1 18.2 17.6 19.2 18.3 9.9 12.0 16.5 14.2 16.9 55.7 22.8	\$5 59 12 25 12 27 16 55 22 83 25 60	\$12 22 6 75 15 75 1 80 8 66 5 28 23 25 16 97 20 60 5 86 9 14 12 03 13 46 10 40 9 56 22 23 16 47 9 65	\$16 67 6 38 5 59 1 72 3 04 5 35 7 05 13 02 14 21 8 03 9 79 13 38 12 60 11 55 8 47 9 63 22 30 11 05		\$7 05 4 05 12 12 75 4 90 4 52 15 33 13 58 12 88 1 84 4 81 8 06 3 68 6 27 3 05 13 08 5 20 4 39	\$9 95 3 87 5 04 62 1 64 4 46 9 00 9 08 9 47 2 89 3 53 10 36 5 82 8 40 4 32 7 36 4 465 11 73
Average		24.3	22 2	19.3	\$15 85	\$12 23	\$9 99		\$6 98	\$6 23
	1	1	1	AREA	AA-5,	1		1 (1
30	15.8 32.9 15.4 15.1 18.0 14.6 19.4 8.6 29.4 40.4 39.5 33.5	6.3 10 3 31 2 26 3 20 2 19 8 18.1 22.4 13.8 25 9 18 4 21.5 13.5 25.1 27 3 22 6 11.4 21 0 25 5 24 1 24 1 13 2			\$13 96 1 95 12 32 18 47 15 90 7 40 11 78 9 34 3 48 26 59 21 00 13 48 8 90 43 69 20 96 31 30 17 10 20 62 19 95 24 82 17 47 16 50 22 60	\$13 68 2 86 16 96 16 48 14 09 10 57 8 30 9 14 5 13 20 37 20 32 13 92 		\$19 48 2 69 6 48 9 81 5 62 4 30 7 28 2 76 17 73 17 26 8 34 12 42 17 83 6 23 9 51 6 12 8 74 11 82 12 05 7 59 22 23	\$26 06 3 33 6 52 7 52 8 37 6 41 5 50 4 90 4 46 9 44 13 25 7 77 14 37 9 04 12 12 8 24 17 02 13 17 13 13 15 08 7 53 14 98	

Area W-1 includes the walnut sections of Orange County exclusive of the La Habra District.

The average given is that for the entire area in walnuts on each farm covered by the records.

Area W-2 includes the following districts: Chino, Pomona, Puente, El Monte, West Covina, Whittier, La Habra, and Rivera.

AVERAGE DEPTHS OF WATER APPLIED AND AVERAGE COSTS OF WATER PER ACRE AND PER ACRE-FOOT FOR 45 LIMA-BEAN FIELDS, SOMIS, VENTURA COUNTY 1928 TO 1931. DATA FROM ZONE MUTUAL WATER COMPANIES 1 AND 2

Zone Water Company No. 1

Serial number	Averag	ge depth of i	rrigation, in	ehes¹		Water costs	s, per aere²	
Seriai number	1928	1929	1930	1931	1928	1929	1930	1931
1	10.2 18.5 10.4 22.1 12.4 31.0 24.3 11.9 27.7 16.4 17.6 8.3 54.2 15.2 16.7 16.6	10.3	6.0 23.0 33.9	9.4 14.7 19.5 23.8 12.2 21.1 21.7 16.4 10.1 19.7 15.3 18.9		\$10 00 14 06 11 50 10 25 28 19 28 00 25 26 88 19 19 9 56 16 31 23 88 3 44 16 69		\$5 88 9 19 12 19 14 88 7 63 13 19 13 56 10 25 6 31 12 31 9 56 11 81 16 56 9 94 7 75
Average	18.8	26.6	20.7	17.2	\$11 76	\$16 64	\$12 92	\$10 73

Zone Water Company No. 2

					1		1	
33	8.3	11.4	12.1	4 6	\$ 6 91	\$9 50	\$10.08	\$3 83
34	17.1	14.0	24.1	14.5	14 24	11 66	20 08	12 08
35	15.3	29.0	27.5	9.9	12 74	24 16	22 91	8 25
36	9 7	24.7			8 08	20 58		
37	16 3	11 3	5 6		13 58	9 41	4 66	
38	16.9	20.8		16 9	14 08	17 32		14 08
39	26.9			18 6	22 41			15 49
40	20.0		21.7	22.8			18 08	19 00
41			10.1				8 41	
42	13 9	7.7	10.0		11 58	6 41	8 33	
43	7.0				5 83			
44	13.0	15 0	31.1	9.9	10 83	12 50	25 90	8 25
45				6.7				5 58
	7.4.4	1/1 7	17 0	12.0	£19.00	\$12 O.4	914.00	£10 C0
Average	14 4	16.7	17-8	13 0	\$12 02	\$13 94	\$14.80	\$10 82

The average given is that for the entire area in lima beans on each farm covered by the records. Water charge per acre-foot, Zone Water Company No. 1, \$7.50; Zone Water Company No. 2, \$10.

Thus far these investigations have mainly related to citrus fruits. Trial plots were selected in the various climatic zones with a view to determining the amounts of water it is necessary to apply to maintain available moisture in the soil at all times. Records of soil moisture variations were kept by means of frequent soil samplings and the

¹ See footnote p. 19 for brief discussion of the principles involved.

water applied to the orchards was measured. This procedure made it possible to secure rather definite figures concerning the net irrigation requirements of citrus fruits. Differences in amounts and distribution of rainfall and differences in seasonal temperatures alter the irrigation requirements and in some seasons winter irrigation is necessary to produce cover crops. It was found that the net irrigation requirements for mature citrus groves in a "mean" year vary as between the different climatic zones approximately as shown in Table 44.

TABLE 44

MEAN NET IRRIGATION REQUIREMENTS FOR CITRUS FRUITS IN THE COASTAL, INTERMEDIATE, AND INTERIOR CLIMATIC ZONES OF THE SOUTHERN CALIFORNIA COASTAL PLAIN

Climatic zone	Average irrigation	Approximate percentage of irrigation water required, by months						
	requirement, inches	Мау	June	July	Aug.	Sept.	Oct.	
Coastal. Intermediate Interior.	15 to 18	5 5 7	15 17 18	20 20 22	18 18 20	15 15 15	10 10 10	

CHAPTER VI

AREAS AVAILABLE FOR EXTENSION OF AGRICULTURE IN THE SOUTHERN COASTAL PLAIN

NATURE OF STUDY OF LANDS AND SOURCES OF DATA

While the main purpose of this chapter will be to present an inventory of undeveloped agricultural lands in the areas included within this study, it will deal also with irrigated lands now in annual crops which can be considered adapted to the growing of "permanent" crops, especially citrus. Land groupings have been made largely on a physical basis, soil, climate, and topography determining crop adapta-Most of the better lands have been developed. There are, bility. however, some areas of good land without a water supply and some

developed lands with only a partial supply.

The citrus industry, which is the basis for the larger part of the agricultural wealth of the area under study, has been able to stand unusually high water costs relative to water costs for most plantings. Most of the water-development projects have been based on water costs the owners of citrus orchards have been willing to pay. It is for this reason that particular attention has been given to a determination of the extent of the land not now planted to citrus that, from a physical point of view, can be considered adapted to the growing of citrus fruits. It is not held, however, that it is economically practical or advisable that all this land be so planted. The rate at which citrus production is increasing in the United States is sufficient reason to question the extension of citrus except in areas capable of withstanding severe competition. The general profitableness of the industry during an extended period in the past has caused development of foothill areas, and boulderstrewn alluvial fans, that, from a soil point of view, are not considered to be of high quality. Changes in the economic status of the eitrus industry may cause decided changes in land values and in the nature of new agricultural development.

Detailed surveys of the agricultural lands, made by the Division of Water Resources, were available for Ventura County and for the division classed as the "South Coastal Basin," but were not available for San Diego County. Information on the agricultural areas of that county was secured, however, from the office of the County Agricultural Commissioner, from the Farm Advisor, from various Soil Surveys,1 from an unpublished report by Professor S. H. Beckett,2 and from a

general survey of the lands by the writers.

2 Beckett, S. II., "Economic utilization of the irrigation resources of northern San Diego County, California." (Unpublished.)

Storie, Earl R., "The classification and evaluation of the soils of western San Diego County," University of California Agricultural Experiment Station Bulletin 552, June, 1933, "Reconnoissance soil survey of the San Diego Region, California," U. S. Dept. of Agr., Bureau of Soils, 1918. Office maps of the Division of Soil Technology, University of California, showing results of the detailed survey made in cooperation with the United States Department of Agriculture during 1929

Table 45 presents a record of the crop acreages for San Diego County, the irrigated acreages of the South Coastal Basin, and that part of Ventura County included within Santa Clara River Valley and the valleys and plains lands lying to the south and west. The maps in the envelope at the back of the report indicate, for the areas surveyed by the Division of Water Resources, the location of areas segregated according to crop and to other uses. This segregation in the South Coastal Basin has been as follows: garden and field crops, citrus, deciduous, alfalfa, irrigated grass, domestic and industrial, unirrigated valley land, and unirrigated hill land. The grouping for Ventura County has been on a slightly different basis, namely: citrus and avocados, decidnous fruits and grapes, walnuts, beans, beets and hay, alfalfa, truck and miseellaneous garden, and subdivisions. Foothill and mountain lands are indicated by hachure.

AGRICULTURAL LANDS IN SAN DIEGO COUNTY

Physical Characteristics.

The agricultural lands of San Diego County lie mainly in the western half, along the coastal plain and in the small valleys immediately adjacent to it. The eastern part of the county is mountainous, and from it there are numerous drainages which extend in a westerly direction to the sea, crossing and dividing the coastal plain into many separate units. The mean seasonal rainfall in the agricultural area of the western part of the county varies from 10 to 17 inches. On the higher lands in the middle and eastern parts of the county the rainfall is much higher, 47 inches being reported as the average seasonal rainfall at Mt. Palomar.

Detailed soil surveys of the western half of San Diego County and part of Orange County were made during 1929 and 1930 by the Division of Soil Technology of the University of California and the Bureau of Chemistry and Soils of the United States Department of Agriculture, the reports of which have not yet been published. When published they will appear in three reports and will be designated as the Capistrano, Oceanside, and El Cajon areas. Storie describes the boundaries of these areas as follows:

The Capistrano Area covers those portions of Orange and San Diego counties lying south of Township 6 south and west of the Riverside County line, while the south boundary coincides with the south boundary of the Santa Margarita Rancho. The Oceanside Area lies to the south and covers the territory from the coast east into the mountains beyond Pala, Pasqual, and Poway valleys, and south to the north line of Township 15. The El Cajon Area extends south to the international boundary and east well into the mountains beyond Lyons Valley. Together these surveys cover all the western half of San Diego County and include most of the agricultural lands.

The publication to which reference was made above presents a detailed classification of the soils of the three areas into agricultural grades, the rating of the agricultural value of the soils being made on the basis of the degree to which they present conditions considered favorable for the growth of plants. A rating of "excellent, grade 1" is given to soils with the most favorable general conditions, while the

¹ Storie, Earl R., "The classification and evaluation of the soils of western San Diego County," University of California Agricultural Experiment Station Bulletin 552, June, 1933, p. 3.

TABLE 45

IRRIGATED ACREAGE IN SOUTH COASTAL BASIN AND THAT PART OF VENTURA COUNTY INCLUDED WITHIN SANTA CLARA RIVER VALLEY AND THE VALLEYS AND PLAINS LANDS LYING TO THE SOUTH AND WEST, TOGETHER WITH A RECORD OF ACREAGE IN CROP IN SAN DIEGO COUNTY, 1932

Data for the first two areas are from the State Division of Water Resources; information on San Diego County from office of San Diego County Agricultural Commissioner.

9	Domestic and industrial	248,100
28:	Total	435,700 103,487 777,644
	Miseellaneous	1,091
	Truck	5,891 11,577
	Field	144,300 42,565 926,560
Aereage	Alfalfa	25,900 5,159 2,500
	Grapes	(4) 217 5,383
	Deciduous fruits and nuts ¹	67,100 24,897 5,784
	Avocados	(4) 190 8,300
	Citrus	198,400 23,477 *16,340
	Division	South Coastal Basin 2. Ventura County 4. San Diego County 7.

Wahut acreage makes up a large percentage of the acreage in the South Coastal Basin reported under this heading; wahut acreage in Ventura County, 22,132; in San Diego, 1,737.

Included with citrus.

Included with decidnous.

Included with field crops.

* Does not include the area to the north of Santa Clara River.

* Includes some nonirrigated acreage. Total irrigated area in San Diego County is approximately 50,000 acres.

Includes 1,425 acres of other subtropical fruits.

Does not include hay and grain crops.

other soils are rated in comparison with them. Six soil grades are listed, as follows:

- 1—Excellent soils, index 80–100
- 2—Good soils, index 60-80
- 3—Fair soils, index 40–60
- 4—Poor soils, index 20-40
- 5—Very poor soils, index less than 20
- 6-Miscellaneous nonagricultural materials, index 0-5

The locations of the several grades are presented in figures 17, 18, and 19 in the bulletin referred to. The original maps from which these figures were reproduced were made available for planimetering the aereage of the various grades of land in each. These acreages are summarized in Table 46, which covers not only western San Diego County, but also that part of Orange County which is out of the Santa Ana River drainage. The figures are for gross acreages and, therefore, include all waste land.

TABLE 46

SUMMARY OF LANDS IN THE WESTERN HALF OF SAN DIEGO COUNTY AND IN PART OF ORANGE COUNTY FALLING WITHIN GRADES 1, 2, AND 3, AS OUTLINED IN UNIVERSITY OF CALIFORNIA AGRICULTURAL EXPERIMENT STATION BULLETIN 552

		Gross acreage					
County	Soil area		Grade				
		1	2	3	Total	all grades	
Orange San Diego San Diego San Diego Totals	Capistrano Capistrano Oceanside El Cajon	11,997 11,960 26,624 18,895 69,476	9,571 17,718 70,813 9,820 107,922	4,519 21,734 56,981 39,838 123,072	26,087 51,412 154,418 68,553 300,470	108,112 176,991 369,360 405,130 1,059,593	

In fully developed areas there is always some acreage which is devoted to roads, farmsteads, drainage canals, etc. The highest utilization of the land is usually found on the best soil. If the soils were all in one unit, rather than in many isolated tracts, it would seem fair, when estimating the area of undeveloped land that is likely to be utilized, to assume a net figure of 90 per cent for grade 1 soils; 85 per cent for grade 2; and 80 per cent for grade 3.

According to the system of soil groupings used by Storie, out of approximately 1,060,000 acres, only about 300,000 acres fall within the agricultural soil grouping of "fair" to "excellent," the remainder being in the range "poor" to "nonagricultural." The soils classed as nonagricultural include the following: rough mountainous land, rough broken land, rough stony land, river wash, tidal marsh, coastal beach, and dune sand.

Some of the land classed as poor is planted at the present time, and with shallow-rooted crops is producing fair results. It is felt that, in general, the rating given by Storie, in the publication mentioned previously, can be accepted as representing the agricultural value of the

soil. However, some of the land in his grade 4 is being utilized advantageously. This is true of the Chula Vista district, where truck and lemon growing have been rather successful.

Irrigated Areas.

Table 47 summarizes the irrigated acreage in San Diego County by districts and according to sources of water supply. While the figures for the acreage served by pumping plants are for 1931, it is felt that no material changes in acreage have occurred since that date.

TABLE 47 ESTIMATED ACREAGE OF IRRIGATED LAND IN SAN DIEGO COUNTY

The acreages in the organized areas are for the year 1932, while the estimate of the area served by pumping is for the year 1931

Water system or location	Gross acreage	Aereage irrigated
rigation districts:		
Fallbrook La Mesa, Lemon Grove, and Spring Valley	10,217	1,400
Lakeside	19,245 320	3,432
Ramona	2700	2400
San Dieguito	3,900	2,200
San Ysidro.	500	110
Santa Fe.	10,106	3,010
Vista	18,296	6,524
Totals.	63,204	17,117
utual water companies: 2		
Escondido	10.638	5.808
Oceanside	4.500	³ 2,400
Rivervicw Farm	600	600
Totals	15,738	8,808
ublic utilities: 4	}	
Sweetwater Water Company	8,000	5,000
rivate pumping plants: 5		
Santa Margarita Ranch		800
San Luis Rey Valley		3,000
Valley Center-Bear Valley		1,000
Escondido-San Pasqual.		2,000
Poway		200 700
Mission Valley-Santee-Lakeside		3,000
Alpine-Descapso		250
Sweetwater Valley-Jamacha-Jamul		2.500
Otay		350
Tia Juana Valley		750
Cottonwood-Potrero-Campo		750
El Cajon		1,500
Miscellaneous		1,000
Totals.		17.800

¹ Unless otherwise noted, information on irrigation districts is from Bulletin 21-D, "Irrigation Districts in California," Division of Water Resources, State Department of Public Works. The area reported irrigated in Fallbrook Irrigation District receives its water entirely from private pumping plants.

Description of Local Areas.

El Cajon soil area.—There is in the Tia Juana Valley a gross area of approximately 2500 acres of grade 1 and about 700 acres of grade 3 land. Large areas of bench land of poor quality border the valley. The net irrigated area at the present time does not exceed 1000 acres.

Information from J. G. France, County Agent, San Diego County

For the year 1931.

Information from water company's report to State Railroad Commission.
Information from "The Agricultural Industry of San Diego County," fourth edition. Published by The San Diego California Club and the County Board of Supervisors. Area irrigated by private pumping plants in Fallbrook Irrigation District is included under irrigation districts.

A gross area of about 1250 acres of grade 1 land is found in the valley and flood plain of Otay River. The present irrigated development includes about half the area of good grade soils.

While a considerable acreage of plains land in the Chula Vista-National City area has been planted, mainly in lemons and truck, most of the district remains undeveloped. This has been due to a lack of water, to uneven topography, and to a soil that offers many problems. Some areas of good soil are found in the plains land soil of this area, but in the main the soil falls in grade 4. The developed area around Bonita, although of a different soil type, has many of the problems common to the Chula Vista district.

The agricultural commissioner of San Diego County reports approximately 2000 acres of citrus fruits, mainly lemons, planted in the National City, Chula Vista, Nestor, and Sweetwater Valley districts. Lemon production has proved rather profitable in this area during the period of high lemon prices. This has been the result of a high percentage of summer fruit which brings premium prices.

The recent alluvial soils in Sweetwater Valley are rather highly developed, mainly to truck crops. Practically all of the gross area of

2300 acres of grade 1 soils is utilized.

Narrow tracts of good soil are found in Paradise, Las Choyas, and

South Las Choyas valleys.

The large body of Redding gravelly loam and sandy loam soils which occupy a large area to the north and east of the city of San Diego are of low agricultural value—too low to justify development of a water supply for agriculture.

Some 2000 acres of grades 2 and 3 soils are found in the La Mesa-Mt. Helix districts. A large part of the better grades of land has been

developed to citrus and avocados.

Bordering Sweetwater River above Sweetwater Reservoir are approximately 4000 acres of grade 1 soil, and on the adjoining plains is a like acreage of grade 2 soil. A net area of 2500 acres in this valley is reported as being irrigated by pumping.

Isolated tracts of fair to good soils are found around Jamul.

Jamacha, Dehesa, Alpine, and Dulzura.

El Cajon Valley proper includes a large area of soil which was classed as Placentia in the reconnoissance soil survey of 1915, but was recognized, in the detailed survey of 1930, as belonging to the Merrian series. The surface soil is usually a sandy loam, but the refractory eharacter of the subsoil cause it to be placed in grade 3, fair, soils. Much of the valley floor is dry-farmed to grapes. There are some 18,000 acres of this type of soil in the valley, but little of this area is irrigated. The recent alluvial soils at the rim of the valley and the deeper residual soils on the slopes have been largely planted to oranges.

Along San Diego River to the north of El Cajon Valley, and to the north of the city of San Diego, lie some 2000 acres of land classed as grade 1, 3000 acres as grade 2, and 1800 acres as grade 3. Table 47 shows a net area of 3000 acres in the Mission Valley-Santee-Lakeside

district as being irrigated by pumping.

In Rose and San Clemente canyons, west of La Jolla, are about 2200 acres of recent alluvial soils. The soils of the upper valleys are rather coarse and subject to floods. About 500 acres, lying below the junction of the two streams, are of high quality.

Oceanside soil area.—Table 46, which lists the acreages in the various soil grades, shows the following acreages for the Oceanside soil area: grade 1, 26.620; grade 2, 70.810; grade 3, 56.980; total for the area 369.360. It will be recalled that this area extends from the south boundary of the Santa Margarita Rancho southward to the north line of Township 15, and from the coast to the mountainous area beyond Pala, Pasqual, and Poway valleys.

Grade 1 soils are found mainly in the valleys and are of recent alluvial origin. Grade 2 soils include the residual soils of the Escondido. Vista, and Fallbrook districts, and the plains soils bordering the coast.

While soils of good quality are found along the coast adjacent to the towns of Del Mar, Encinitas, Carlsbad, and Oceanside, together with a long strip south of San Onofre, much of the plains land and adjacent foothill land is of low agricultural value.

A water supply has been developed for most of the good-quality soils lying between Oceanside and Del Mar. The main exception to this is an area of approximately 2000 acres of grade 2 soil lying adjacent to the coast between San Marcos and Los Monos creeks.

A large acreage of undeveloped grade 2 land lies to the south of Escondido, south of San Dieguito River. Some grade 1 and grade 2 lands are also found to the north of the town.

A rather large block of fair-quality soil, grade 3, is found near San

Mareos. Part of the land at present is dry-farmed to grapes.

Vista Irrigation District includes within its boundaries 18,206 acres, mainly grade 2 soils. According to district records, 6524 acres were irrigated during 1932. Large plantings of avocados are found in this district.

Approximately half of the grade 2 soil in the Oceanside soil area is found near Fallbrook, this being the largest unit of undeveloped good soil in San Diego County. Fallbrook Irrigation District includes 10.217 acres, 1400 being irrigated, entirely by private pumping plants, during 1932.

Capistrano soil area.—This area, which includes that part of Orange County lying below Township 6, and Santa Margarita Rancho in San Diego County, comprises some 285,100 acres, 108,100 acres being in Orange County and 177,000 in San Diego County. The land within San Diego County is grouped as follows: grade 1, 11,960 acres; grade 2, 17,720 acres; grade 3, 21,730 acres. Grade 1 soils are found along Santa Margarita, Las Pulgas, San Onofre, and San Mateo rivers, the largest block being in the valleys of the last two streams. These valleys are well suited to the growing of truck and field crops. The soils near the upper ends of the alluvial fans are coarse and subject to flood. For this reason they have been placed in grade 3.

About 6000 acres of grade 2 soils occur to the west of Fallbrook, while a block of similar quality and of nearly equal size is found in the

vicinity of Deluz.

Grade 2 soils here, as in other parts of San Diego County which have been described, seem well adapted to the growing of subtropical crops.

The long, narrow strip of grade 2 soil lying along the coast south of San Onofre comprises about 2000 acres. It is now dry-farmed to beans.

Two large blocks of grade 3 soils, totaling about 9500 acres, occupy

the elevated plains about 12 miles northeast of San Onofre.

An estimate of the irrigated acreage in that part of Orange County which is included in the Capistrano soil area is not available. The grade 1 soils, however, are rather highly developed, and the grade 2 soils around Capistrano have a considerable acreage of citrus plantings. Grade 1 soils are found along San Juan, Trabuca, and Aliso creeks. Grade 2 soils occupy the sides of the lower river valleys and to some extent the bench lands along the coast south of Laguna Beach.

Summary of Agricultural Lands.

Using the percentage previously mentioned to estimate the net irrigable acreage in the various soil grades, viz.: 90 for grade 1, 85 for grade 2, and 80 for grade 3, the following approximate acreages are secured for the western half of San Diego and that portion of Orange County south of the Santa Ana River drainage basin: grade 1, 62,500; grade 2, 91,700; grade 3, 98,500. Of these areas, 10,800 acres of grade 1, 8100 acres of grade 2, and 3600 acres of grade 3 are in Orange County.

To summarize the agricultural land situation in the western half of San Diego County and that part of southwestern Orange County which is outside the drainage of Santa Ana River, it can be said that approximately 60 per cent of the total land surface has soils of little

or no agricultural value, as far as irrigated crops are concerned.

AGRICULTURAL LANDS IN THE SOUTH COASTAL BASIN

It will be to the convenience of the reader if he will refer to the crop survey map, in the envelope at the back of the report, while reading the description of the physical characteristics of the unirrigated portions of the South Coastal Basin. (Plate A.)

Description of Local Areas.

Near the lower right-hand corner of the map is shown an area of approximately 20,000 acres of unirrigated, undeveloped plains and valley lands extending between Corona and Lake Elsinore. Climatically, most of the district is adapted to the growing of citrus fruits. However, the irregular contour and the rocky soils limit the potential net agricultural area to not more than one-third of the gross acreage reported.

Bordering the citrus plantings to the south of the city of Corona is a fringe of land of approximately 5000 acres, which from a climatic, soil, and relief point of view can be considered adapted to citrus production. The elevated position of much of the land, however, might

prevent the delivery of irrigation water at a reasonable cost.

Forty-five hundred acres of undeveloped foothill land are shown along the hills to the east of Riverside. Some of these lands have had eitrus plantings on them, but are now bare.

Extensive areas of unirrigated valley and plains land extend along Santa Ana River from near Colton to the canyon southeast of Chino. This section is not generally considered adapted to citrus. Much of the area is dry-farmed to grain. With the exception of the coarse-textured, low-lying soil types, most of the recent alluvial soils are adapted to the growing of field and truck crops.

The map shows large areas in yellow in the Beaumont and Yucaipa districts. Deciduous fruit plantings make up the main part of the present irrigated area. If irrigation is to be extended in these two sections, it seems logical to assume that the plantings will continue

along the same general lines as at present.

Approximately 18.000 acres of undeveloped land is shown bordering Santa Ana River north of Redlands. This area is of very low agricultural value.

Bordering Cajon and Lytle creeks is a large body of unirrigated land. High winds and rocky soil make a large part of this area unfavorable for agricultural development. Adjacent to the hills on the northeast side of the valley and in small coves on the west side, are small areas of land, totaling about 2000 acres, having soil, climate, and topo-

graphy which seem favorable for citrus.

A large unit of unirrigated land lies between Lytle Creek and San Antonio Canyon and between the Sierra Madre range and the valley lands to the south. The western portion of this area lying above the Foothill Boulevard comes within the intermediate climatic zone, and wind is not a serious problem, so that climatically it is adapted to citrus. Winds and temperatures, however, increase toward the east. Topographically the land is smooth and relatively flat from east to west, but from south to north there is a rather uniform increase in elevation, the plains lands joining the mountains in some places at an elevation of 2500 feet. The wind hazard in much of this area, and the extremely rocky nature of a large part of it, makes a high percentage of this area of low agricultural value. Extensive water-spreading works are being constructed on the washes of Lytle, Cucamonga, and San Antonio creeks. This appears to be using these rocky areas to best advantage.

It is felt by men experienced in the growing of citrus fruits that the Foothill Boulevard marks, in a general way, the southern border of the potential citrus land in this area. However, the land adjoining the mountains is at such high elevation that very high pumping heads will

be necessary to provide water for it.

Practically surrounded by the western and central portions of this large area of undeveloped land are the established citrus districts of Upland, Etiwanda, and Alta Loma.

After going over the large block of land lying to the north of Foothill Boulevard in considerable detail, the following assumptions

seem reasonable:

1. That only high-return crops will stand the development and

operating costs necessary for farming it.

2. That the following approximate acreages should be excluded as nonagricultural because of the rocky character of the land: 3000 acres in San Antonio Wash, 4000 acres in Cucamonga Wash, and 6000 acres to the east of Magnolia Avenue, together with about 3000 acres along the base of the Sierra Madre which lie at such an elevation as to require very high pumping lifts if water is to be delivered to them. This leaves

approximately 16,000 acres gross in the block which under favorable

price conditions might be considered to be potential citrus lands.

A large percentage of the unirrigated land lying to the south of Foothill Boulevard is now dry-farmed to grapes. Topographically the land is well suited to cultivation and irrigation. The soils, however, are coarse-textured and wind-swept. It is not considered to be adapted to eitrus growing. There is no apparent reason to expect the character of development there to change from that found at present.

Near the mouth of San Dimas Canyon is a horseshoe-shaped body of unirrigated land of approximately 1000 acres. With a water supply

this would go into the potential citrus area.

A large block of land of good quality, undeveloped agriculturally, is found near Sierra Madre. This land is now mainly in park use.

The narrow fringe of land, shown in yellow at the northwestern base of the hills extending from La Verne to Puente, is of low agricultural value. The same is true of the undeveloped area shown along the San Gabriel River to the northeast of El Monte.

A relatively small acreage of potential citrus land lies between Puente and Pomona, mainly on the south side of Valley Boulevard.

There is a large horseshoe-shaped area of land in southeastern Orange County which is now without an irrigation water supply. This area is usually dry-farmed to beans, but with water about 12,000 acres would be well adapted to a wide range of crops, including citrus. The soil map of the United States Bureau of Soils shows much of the southwestern portion of the undeveloped area (south of Newport Avenue) to be too alkaline for intensive development.

A large aereage in the Santa Ana River plain southwest of Santa Ana has remained fallow even though the pumping heads are not high. Since the area is spotted with alkali, the cropped areas are discontinuous. The soils are, in the main, coarse-textured and of recent alluvial origin. With drainage and reclamation much of this soil could be developed to deep-rooted crops. However, the fact that these large acreages have remained undeveloped would seem to indicate that their owners have considered the reclamation to be unprofitable under the conditions that have prevailed.

The land situation in the San Gabriel plain is not unlike that of the Santa Ana plain; that is, the soils are spotted and there are numerous uncultivated areas. Only field and truck crops are grown in

the lower portion of this plain.

As in the case with production-cost and yield records, San Fernando Valley has not been included in this discussion.

Summary of Agricultural Lands.

Table 48 presents an inventory of undeveloped plains and valley lands in the South Coastal Basin.

AGRICULTURAL LANDS IN A PORTION OF VENTURA COUNTY

In the discussion which follows concerning agricultural lands in Ventura County, reference is made to the crop map in the envelope at the back of this report. (Plate B.)

¹ Soil survey of the Anaheim area, California, U. S. Dept. of Agr., Bureau of Soils, 1919.

TABLE 48

ACREAGES OF UNIRRIGATED VALLEY LANDS, BY DRAINAGE BASINS AND BY COUNTIES, AS SHOWN BY THE CROP SURVEY OF THE SOUTH COASTAL BASIN BY THE DIVISION OF WATER RESOURCES, TOGETHER WITH AN ESTIMATE OF THE NET IRRIGABLE ACREACES REMAINING AFTER DEDUCTING THE LARGE BLOCKS OF LANDS CONSIDERED NONAGRICULTURAL

			Acreage			Approximate		
Area		County	nty		-	nonagricultural	Gross acreage of agricultural	Estimated net acreage of irrigable
	Los	Orange	Riverside	San Ber- nardino		acreages only) 1	lands	lands 2
San Gabriel Valley. Coastal Plain. Santa Ana Valley.	41,000 85,000 5,600	74,000	5,700 62,000	145,000	41,000 164,700 212,600	13,000 13,000 62,000	28,000 151,700 150,600	23,800 128,900 128,000
Totals	131,600	74,000	67,700	145,000	418,300	88,000	330,300	280,700

¹ This column includes the total acreage of large blocks of lands considered nonagricultural and which are included in the total in the preceding column.
² Figures in this column have been obtained by taking 85 per cent of the gross acreage. This is based on the assumption that, even under full development, about 15 per cent will not be irrigated.

Santa Clara River Valley and the Oxnard plain (extending into Pleasant Valley as far east as U. S. Highway 101) include about 70 per cent of the agricultural land of Ventura County. Practically all of the high-quality land in these areas is under crop and being irrigated. Any extension of the irrigated acreage will have to include the foothill slopes which are now mainly dry-farmed to lima beaus.

Las Posas, Simi, Pleasant, Santa Rosa, and Conejo valleys lie to the south of Santa Clara River Valley. In general, agricultural development has not been as complete in these valleys as in Santa Clara River Valley, due mainly to restricted water supplies, and to a higher per-

centage of soils of low agricultural value.

The areas indicated on the Ventura County crop map as habitable foothill areas do not represent conditions comparable with those from which the data on cost and yields have been presented in Chapters II and III. The topography and character of soil place them on a lower basis.

Description of Local Areas.

In Santa Clara River Valley most of the high-quality lands have been planted to orchards, mainly walnuts and citrus. A large acreage, now planted to irrigated annual crops, could be utilized for citrus or walnuts. The unirrigated areas are found near the river or adjacent to the hills. The land near the river is classed as riverwash or coarse sand, both of low agricultural value. The lands lying above the main irrigated areas have older soils. For this reason the subsoils have a tendency to be dense, and, therefore, tend to be less desirable.

The Oxnard plain is intensively used at the present time in the production of field crops. These extend well out toward the coast line, with the exception of the extreme southern part. Natural drainage is restricted on the low-lying areas. This has resulted in a considerable area becoming alkaline. Artificial drainage has, however, resulted in the reclamation of some of these lands. Practically all of the lands lying north of Hueneme Road, with the exception of the very light soils along the highway to the east of El Rio and the large block of Dublin soils along Pleasant Valley Road, generally considered potential citrus lands. The area adapted to walnuts would probably be more restricted owing to the deeper-rooting habits of the walnut tree.

The high-quality recent alluvial soils in the floor of Pleasant Valley are practically all under irrigation. The rimland soils that are not irrigated belong mainly to the Rincon series. A large part of the irrigated bean land in this valley would no doubt be capable of producing eitrus on a basis comparable with groves in area 14 (see appendix.

p. 152).

Beans and walnuts make up a large percentage of the irrigated erops in Las Posas Valley. Citrus is found mainly near the foot of the hills. Some plantings extend onto the hills. Large blocks of undeveloped, elevated plains land are found to the north of Los Angeles Avenue, from Somis to near Moorpark. Most of the recent alluvial soils would be capable of producing walnut or orange crops that would be comparable with the yield data given for the intermediate climatic zone of Ventura County. This can not be said of most of the undeveloped land lying between the alluvial soils and the base of the foothills.

The section around Epworth, north of Moorpark, has some good soils bordering the stream channels. The larger portion of the area. however, has soils of only fair agricultural value.

Most of the soils in the floor of Simi Valley are of medium texture and belong to the Yolo series. Alkali is present in spots near the southwestern end of the valley. The undeveloped, recent alluvial soils of medium texture can be grouped on a basis comparable with the better developed lands of the valley. The main body of undeveloped soil of this type lies at the head of the valley to the east of Santa Susana, and seems capable of producing oranges and walnuts on a basis comparable with production in the interior climatic zone of Ventura County. The bench-land soils lying directly to the south of Simi are of a series not usually suitable for citrus fruits.

The citrus development in Santa Rosa Valley is, in the eastern portion, mainly on older alluvial soils. Only part of the good recent alluvial soils near the lower end are served with water, part of the area being farmed to field crops. The good-quality recent alluvial soils seem suitable for oranges or walnuts.

In the vicinity of Newbury Park there is a large area of undeveloped valley and plains lands. Some small areas of recent alluvial soils are found along Conejo Creek, but by far the greater part of the soils have a fair to low agricultural value. It would not be reasonable to apply Santa Clara River Valley yields and returns to this section.

TABLE 49

ACREAGES OF VALLEY AND PLAINS LANDS AND OF IRRIGATED LANDS, BY DRAIN-AGE BASINS, AS SHOWN BY THE CROP SURVEY OF VENTURA COUNTY BY THE DIVISION OF WATER RESOURCES, TOGETHER WITH AN ESTIMATE OF THE NET IRRIGABLE ACREAGES 1

Basin	Total acreage	Acreage irrigated, 1932	Approximate gross acreage of agricultural land comparable with present irrigated areas 2	Estimated additional aereage that would stand development under very favorable price condition 2	Estimated net acreage of "good" lands	
Santa Clara River Valley in Ventura. County, exclusive of Oxnard plain. Oxnard plain (south of Santa Clara	52,976	30,369	7,750	1,500	6,590	
River and west of Satieoy and Wood Road) Beach lands (west of Oxnard plain)	49,668 6.172	37,641 298	2,100	(2)	1,785	
Pleasant Valley	22,047	15,148	3,750	2,500	3,185	
Las Posas Valley	18,276	10,441	2,280	19,000	1,940	
Simi Valley	12,388 8,267	6,998 2,551	3,025 600	1,700 4,000	2,570 510	
Totals	169,794	103,446	19,505		16,580	

With the exception of a portion of the area north of Moorpark (included in column 5), hill lands are omitted because not considered "irrigable" according to conservative standards of development.

not considered "irrigable" according to conservative standards of development.

Approximate acreage not now irrigated, but which would seem to be capable of standing a water charge comparable with the average represented in the cost-of-production data in Chapters II, III, and IV.

Areas which might be developed under favorable conditions, but which do not have as favorable physical conditions as the bulk of the present irrigated lands.

Figures in this column have been obtained by taking 85 per cent of the gross acreage in column 4. This is based on the assumption that, even under full development, about 15 per cent of the land will not be irrigated.

Owing to ground water and alkali conditious in the lower part of the plains area, a detailed soil survey would be recessary for accurately determining the limits of agricultural land.

necessary for accurately determining the limits of agricultural land.

Table 50, which concludes the present chapter, summarizes the acreages available for the extension of agriculture in the coastal plain of southern California extending from San Diego County to Ventura County, but exclusive of San Fernando Valley, in Los Angeles County, and San Jacinto River Basin, mainly in Riverside County.

TABLE 50

SUMMARY OF NET ACREAGE AVAILABLE FOR THE EXTENSION OF AGRICULTURE IN THE COASTAL PLAIN OF SOUTHERN CALIFORNIA, WITH AN ESTIMATE OF THE AREAS "AVAILABLE" FOR CITRUS FRUITS

Division	Estimated net acreage available for the extension of agriculture	Estimated aercage available for the extension of citrus fruits	Climatic zone	
Western San Dicgo County and that part of Orange County south of township 6. South Coastal Basin (Exclusive of San Fernando Valley) Ventura County (Santa Clara River Valley, and plains and valleys to south and west) Totals.	215,000 238,500 16,500 470,000	\$72,000 \$51,000 \$46,000 169,000	Coastal and intermediate Mainly interior and intermediate Mainly coastal and intermediate	

¹ 85 per cent of gross area of agricultural land suitable for development according to conservative standards.
² "Available" means with soil, topography, and climatic conditions comparable with those in the present developed citrus areas.

² Mainly grade 2 lands.

<sup>Includes about 6,000 acres now planted to annual crops.
Includes about 30,000 acres now planted to annual crops.</sup>

CHAPTER VII

CONSIDERATIONS WHICH GOVERN EXPENDITURES FOR IRRIGATION WATER IN THE COASTAL PLAIN OF SOUTHERN CALIFORNIA

The previous chapters of this report have been devoted to a discussion of factors which enter into the value and cost of water for irrigation in the coastal plain of southern California, to a presentation of data regarding farm costs and income, and to a summarization of available information relating to the amounts farmers are now paying for irrigation water. Soil, climatic, and other physical features of the different "areas" of the southern coastal plain have been described, brief accounts have been given of the status of the more important agricultural products, and the areas available for extension of agriculture have been outlined and discussed. The purpose of this final chapter is to bring out more fully and more definitely the economic and physical considerations which govern expenditures for irrigation water so far as this can be done from the principles discussed and the information gathered in the investigation.

FARM COSTS AND INCOME IN RELATION TO THE VALUE OF WATER FOR IRRIGATION IN THE PRODUCTION OF CITRUS FRUITS AND WALNUTS

One of the principal assumptions on which the present study has proceeded has been that the residual income farmers receive above other costs of production than the cost of water is a useful, if not a controlling, factor in determining the amount it is to the advantage of farmers to pay for irrigation water. Another principal assumption has been that while established farmers will, if necessary, pay for water up to the full amount of their residual income above other costs, and in extreme cases will pay even more than this, a water-development project for new land ordinarily will not be undertaken if prospective water costs will not leave sufficient residual income to enable "good" farmers on "good" land to earn interest at the going rate on money prudently invested in their farm enterprises. Obviously, the smaller the amount the farmers will be required to pay for water, the greater will be their profits or their chance for profits, and the higher will be the value of their land.

With the above assumptions in mind, the major part of the investigation undertaken has consisted in the assembling and analyzing of data relating to the cost of production and farm income for the more important agricultural crops grown in the southern California coastal plain, chiefly oranges, lemons, and walnuts. The basis on which this material was assembled and analyzed is set forth in Chapter I, and the material gathered is presented in Chapters II, III, and IV.

As has been brought out by the data presented in Chapters II, 1II, and IV, significant differences exist in the climate, soil, and cul-

tural conditions in the various parts of the southern California coastal plain. There are also wide ranges in costs of production and yields, and marked variations in prices received for products grown. Because of these differences and variations, not only as between the "areas" set up in the investigation, but also as between the farms within these areas, there is a wide range in the amounts the farmers of the southern California coastal plain will find it to their advantage to pay for irrigation water. For instance, a low frost hazard may offset a high water cost, or vice versa; high infestation of insect pests may so reduce the yield or quality of the product or increase the cost that the residual income is seriously reduced; the ability to market fruit at those periods in the season when prices are highest will give such an advantage to one area or to one grower that materially higher water costs can be paid and still leave a residual income equal to or greater than that received under a lower water cost elsewhere or to a different grower.

Physical Differences Affecting Costs, Yields, and Net Incomes.

The need for taking account of different climatic, soil, and other physical differences in the southern coastal plain in considering the value and cost of water is especially important in connection with citrus fruits, avocados, and walnuts. The nature of the physical differences has been shown, particularly in the descriptions of the 15 orange, 7 lemon, and 4 walnut "areas" for which data relating to the cost of production, yields, and income for these products have been assembled.

Summer temperatures are responsible for the existence of what have been termed the coastal, intermediate, and interior climatic zones in the southern coastal plain, and largely determine the selection of varieties. Assuming that the varieties are planted in the zones to which they are best adapted, frost hazard and wind hazard are the climatic factors which most affect costs of production and yields of citrus fruits and, therefore, "net" income. The frost hazard is also, of course, a particularly important consideration with avocados.

For instance, taking one of the southern coastal counties as an example, in a few sections the frost hazard to citrus fruits is so slight as not to justify orchard heating. One small area in the county, on the other hand, is reported as requiring 10 firings a year for oranges. In most of the citrus sections of this county from 1 to 4 firings are required annually. In a portion of another county, differently situated, the Frost Protection Service of the Weather Bureau indicates from 5 to 10 heatings a year over most of the area and 14 to 17 in restricted portions.

It has been estimated by a competent specialist in the field of orehard heating that the equipment necessary to heat a 10-acre orange grove will cost, for a representative situation, from \$150 to \$235 an acre under 1932 price conditions, and that the annual overhead for earrying this equipment will amount to approximately \$15 an acre. Tables 8 and 9 in Chapter II, however, report average annual heating costs, including overhead, much less than these figures would indicate are necessary—a range from nothing to about \$7.50 an acre for oranges, and from 47 cents to \$11.45 for lemons. The reason these average costs are so low is that many growers either do not heat or do not heat adequately. In one of the southern counties, the average

cost over a 4- or 5-year period for 45 growers who did heat is reported as \$15.80 an acre a year. Floyd D. Young, Senior Meteorologist in the Weather Bureau in charge of the Frost Protection Service, reports the average annual cost of protecting 281 acres of lemons during the period 1913–1926 as \$72.95 an acre, with an annual average of 17 firings a year, and the average annual cost of protecting 50 acres of oranges in southern California, under 1929 prices, as \$52.62 an acre, with the orchard equipped with double-stack oil heaters.\(^1\) In both cases depreciation and interest are included.

While it may be argued that the cost of heating will not decrease "net" income, as otherwise heating would be eliminated, in the present study heating is, nevertheless, a factor in determining the amount it is worth while to pay for irrigation water, because it is one of the items that must be paid for out of the returns received from the packing

houses.

The cost reported for protection from wind is not large, but in certain sections winds are definitely a limiting factor, this being particularly true in some of the undeveloped areas. In one of the citrus areas described in the appendix, it is reported that an average of 4 per cent of each farm is used up in windbreaks, and in another area an average of 7 per cent.

In the case of damage from both frost and winds, it is not alone the cost of protection that is important, but also their influence on reducing yields and quality which makes it necessary to take frost and

wind hazard into consideration.

The other of the more important physical factors that affect the amount it is to the advantage of the farmers to pay for irrigation water is the soil. In the long run the plantings on the better soils may be expected to stand a higher water charge than those on the poorer soils. In the present study it has not been feasible to attempt any definite correlation between soils and ability to pay for irrigation water. It is merely desired to point out that when the amounts it is worth while for farmers to pay for irrigation water are under consideration, due account needs to be taken of soil differences along with differences in other physical factors that have been referred to. The soil maps prepared jointly by the Division of Soil Technology of the University of California and the Bureau of Chemistry and Soils of the United States Department of Agriculture are particularly helpful in evaluating the soils from the standpoint of their productivity, especially when used in connection with the soil index recently devised by the Division of Soil Technology,²

Types of Farming and Size of Holdings in Relation to the Value of Water.

Although not of major importance in connection with the problem of water costs, types of farming and size of holdings have some relation to it, since both affect the amount of 'net' farm income. In addition to the holdings which are operated strictly as commercial enterprises, with areas ranging from a possible minimum of 10 acres to a maximum of several hundred acres in highly intensive development, at least three other distinct types can be recognized. These are the 'small farm

¹ U. S. Department of Agriculture Farmers' Bulletin 1588, pp. 41 and 44. ² Storie, R. Earl, An index for rating the agricultural value of soils. Calif. Agr. Exp. Sta. Bul. 556.

homes" of one or two acres or less which are increasing in numbers near the larger population centers and are occupied mainly by industrial or other city workers; the "small farms" of 2 or 3 to 5 or 6 acres which are partly farms and partly homes and are scattered widely over the southern coastal plain; and the holdings in the choicer foothill residential areas with citrus or avocado plantings which their owners may intend shall be operated on a commercial basis, but for which the values for residential purposes may justify expenditures for water in excess of its value on a strictly commercial holding. These special types of holdings need to be distinguished from the strictly commercial farms with which the present report primarily deals.

No effort has been made in the investigation to deal with water values and water costs on the commercial farms that are clearly sub-It has become clear in this study, however, that owners of submarginal farms may sometimes be forced to pay a higher cost for water than can be paid and still keep expenses within income. may even find it to their advantage to do this in order to maintain at least some value in their farm investments. They may materially reduce their expenditures for tillage, fertilization, and some other cultural operations, and perhaps keep their orchard plantings alive, but their plantings will die within a few seasons if water is withheld. the plantings are to be commercially successful, however, at least the minimum cultural requirements which experience has shown are necessary must be met, and if the income is not sufficient to cover these and also pay whatever it is necessary to pay for irrigation water, the plantings cease to be of sufficient commercial value to justify their maintenance as business enterprises. To the marginal and submarginal farmer, therefore, the amount of the water charge is a matter of great importance.

Although the size of holdings which are not operated on a strictly commercial basis is not of importance in connection with the problem of irrigation-water costs, it is of importance in the commercial plantings, especially in the smaller ones, such as those of 10 acres, which are the sole source of income to their owners. On such holdings the first consideration is to obtain sufficient "net" income to cover family living expenses according to the standards the farmer seeks to maintain. These smaller holdings offer but little opportunity for the owners to earn "wages" on their holdings, because, in the case of citrus fruits at least, probably not over one-third of their time can be employed productively, even including miscellaneous activities and time necessarily lost between required cultural work. The Agricultural Extension Service of the University of California has estimated that the actual time necessary to perform the various cultural operations on a citrus grove. exclusive of the work which it is customary to have done by contract or by the marketing associations, does not exceed approximately 42 hours an acre a year, or about 52 working days on a 10-acre tract. This is the time actually needed in connection with irrigation, fertilization, disease control, pruning, and tillage. Fumigation and spraying are

¹ Ross H. Gast, in charge of the small farm home movement for the Los Angeles Chamber of Commerce, secured data for the writers on the cost of water on nine such holdings, ranging in size from one-half to one acre. The costs ranged from \$23 to \$57 an acre and averaged \$39. These costs do not vary materially from those paid in commercial holdings. However, the Los Angeles Chamber of Commerce reports that water costs are usually "quite high" on small subdivisions.

ordinarily done on contract, because it is not economical for the owner of a small tract to own the heavy equipment needed for these operations. Harvesting the crop is done by the marketing associations.

With this small opportunity to earn wages on his own farm, the owner must save sufficient out of his net income to meet his family requirements. It therefore seems clear that the farmer who is solely dependent on a 10-aere citrus grove in southern California is vitally concerned with the amount he must pay for irrigation water, and that he will have less available for water than the owner of a larger commercial planting will have.

Taxes in Relation to the Value of Water.

Taxes are one of the larger items in the cost of producing the orehard crops in southern California, ranking along with the cost of water for irrigation and not infrequently exceeding it. Reduced to averages for the separate areas treated, the taxes on the orange and lemon groves included in the study range from \$12.97 to \$34.63 an acre. Eliminating the two areas showing lowest average taxes, the range is from \$22.86 to \$34.63. These were the amounts paid during the period covered by the records, without reduction to anticipated lower figures. In the case of 97 out of 879 individual orange and lemon records, average taxes exceeded \$35 an acre; in the case of 13, they exceeded \$50; in a few instances, they approached \$100. A frequency distribution of the entire 879 records, without division into areas, gives a definite modal group at \$20 to \$25 an acre. Taxes on walnuts have been slightly lower, the range of averages for the four walnut areas being \$11 to \$29, and the modal figure \$20 an acre.

Many of the orehards in southern California are situated within the limits of incorporated cities, necessitating the payment of both eity and county taxes. In general, as might be expected, the taxes reach higher figures in the more fully developed and more populous sections, this being especially true where the city boundaries extend well out into the orehard areas.

While the extreme range in taxes in the citrus and walnut districts is wide, both within and between the different areas, it is not apparent that as between the areas the differences are on the whole significant in relation to net farm income, as shown by the records. However, these differences are significant when comparison is made between what it is worth while for farmers to pay for water in some local sections and in others, especially, of course, where and when the margin of income above costs is relatively low. Furthermore, the taxes are sufficiently high in some of the incorporated areas to emphasize the need of giving them very careful consideration when reaching conclusions as to the amounts it is worth while to spend for additional water supplies.

As might be expected, taxes in the deciduous fruit and the field and truck crop areas are substantially lower than in the citrus and walnut areas. Tables 31, 32 and 33 in Chapter IV bring this out.

Ten apricot records from Riverside County show a range in taxes of \$8.34 to \$13.29 an acre, averaging \$10.35. Ten lima bean records from Orange County show a range from \$5 to \$11.58, with an average of \$8.32. For 17 lima-bean growers in Ventura County the range was from \$6.56 to \$19.86, averaging \$17.66, the land being irrigated. Three

lima-bean records from the same district for nonirrigated land show a

range in taxes paid of 75 cents to \$6.90 an acre.

The average of \$10.35 an acre on the apricot land in Riverside County is probably representative of taxes on deciduous orehards. The higher taxes paid on the average on the irrigated lima-bean land in Ventura County to which the records obtained apply reflect the fact that much of that land is in the citrus and walnut districts, and is potentially citrus and walnut land which temporarily is being used for beans.

It seems apparent from the above summary of taxes being paid on farms of the southern coastal plain that the taxes are generally sufficiently high to make them a factor in determining the appropriateness of expenditures for irrigation water.

Interpretation of Differences in Costs of Production and Yields.

A study has been made of the differences in costs of production and yields, especially in the case of citrus fruits and walnuts, with a view to determining their bearing on the value of water for irrigation. Among the questions which arise are the following:

1. Is it likely that in times of economic stress costs will tend to equalize by reductions where costs are unusually high? And if this occurs, will yields be lowered?

2. Are differences in costs due in part to varying cultural requirements as between the different fruits or varieties, such as lemons and

navel and Valencia oranges?

3. Are the differences in yields shown by the records presented due primarily to environmental conditions, or is it to be expected that yields for any one product or variety will in substantial measure be equalized as cultural practices improve?

Reductions in costs. A study of Tables 11 and 12 in Chapter 11, in conjunction with Tables A and B in the appendix, all relating to citrus fruits, has brought out what already seemed obvious, viz.: that the extremes in costs in any one area result most largely from low or high costs of materials and labor, although in some cases low or high taxes, depreciation, or general expenses, singly or jointly, are mainly responsible. Fertilization and cultivation (tillage) work frequently show wide differences.

The fertilization of citrus groves has now been under intensive study by the College of Agriculture for many years. While the problem is a complicated one and has been the subject of differences of opinion between the College of Agriculture and dealers in fertilizer materials, there seems ample evidence that, as might be considered natural, the high prices received by growers for their products during recent years have led to extravagance in fertilizer applications. Table 8, which gives details as to costs of labor and materials taken from 560 Citrus League orange records from 12 areas, shows average costs of fertilizer materials and application ranging from \$50.98 to \$96.07 an acre. Table 9, giving data for 236 Citrus League lemon records from 6 areas, shows averages ranging from \$26.24 to \$80.27 an acre. The range shown in Table 10 for 81 Agricultural Extension Service records from 8 areas is from \$39.59 to \$133.31. In all cases, individuals within some of the areas show far wider variations.

The specialist in citriculture in the Agricultural Extension Service, after careful study of the situation and with wide acquaintance with the industry in all of its cultural phases, has concluded that a maintenance fertilizer program can be carried out by using 6000 pounds dry of decomposable organic matter (chiefly barnyard manure), 100 pounds of nitrogen from low-cost commercial sources, and a covererop at a total cost in most areas, under present conditions, of around \$35 an acre. Since most of the fertilizers purchased in southern California are used in the citrus groves, it seems a reasonable assumption that organic fertilizer prices will be governed largely by citrus prices. A rise of 30 per cent in present fertilizer prices would make fertilizer materials and applications cost not to exceed \$45 an acre annually. This, it should be remembered, is a maintenance program, and is not intended to be all that can profitably be spent, although approaching that amount for some sections.

Citrus growers with superior soil capable of producing high yields undoubtedly will continue to expend well above the average for fertilization, but the findings of the research workers in fertilizers seem to justify the conclusion that unless prices received for citrus fruit increase more than is generally anticipated for the near future, a substantial percentage of the citrus growers will spend less for fertilization than in the past.

The practicability of reduction in cultivation costs seems to follow from a rather recent change in the concept of the purpose of cultivation. This operation is now rather widely recognized as one that is needed primarily for control of weed growth and to facilitate irrigation operations, rather than directly for moisture conservation through stirring up the soil surface. Tables 8 and 9 show average "cultivation labor" costs in Citrus League orange and lemon records ranging from \$20.65 to \$71.81 an acre. Table 10, giving Agricultural Extension Service records for oranges and lemons, not only shows much lower costs, but also a much smaller range in the averages for the areas, viz.: \$15.81 to \$23.10. "Cultivation labor" costs in the Citrus League records are not, however, fully representative because it has been the practice in gathering such records to place under that heading costs not readily placed elsewhere, especially miscellaneous labor.

In Orange County, where the farm advisor has been perhaps unusually successful in promoting the application of the newer concept of cultivation, substantial reductions in costs have been made. For instance, cultivation costs in Orange County orange groves for which Agricultural Extension Service records are available (Table 10, areas 3, 4, 5, and 6) show average cultivation costs ranging from \$16.42 to \$20.19 an acre, or \$23.10 if the 8 lemon records from area L-3 are included.

All of the citrus sections do not have topography as smooth and as easily tilled soil as in Orange County, so that the necessary cultivation costs in the flatter portions of that county probably are a little less than in areas more rolling and with heavier soil. The general consensus of opinion of those familiar with the production of citrus is that \$20 is an ample average allowance an aere for cultivation in most of Orange County and in areas comparable to it, and that an average of \$25 an acre is a sufficient allowance in the other areas. It is the judgment

of the writers that these conclusions are sound. If so, variations in costs of producing citrus fruits due to differences in the expense of cultivation will tend to diminish.

Variations within the different areas in costs of producing walnuts shown in Table D in the appendix are due largely to differences in material and labor costs, as in the case of citrus fruits, but in some instances differences due to variations in taxes and depreciation are more marked. In each of the four walnut areas labor and taxes are by far the largest items of expense, and in three the amounts for these items are not far apart. In three of the areas depreciation comes next after labor and taxes and materials fourth; in the other area materials come third and depreciation fourth.

Total costs for walnuts are very much less than for citrus fruits. This is largely because fertilization, frost protection, and pruning are

negligible items in walnut production.

The point has been raised as to whether reduction in the cost of producing orehard products, chiefly through reducing costs of fertilization, cultivation (tillage), and irrigation, is likely to reduce yields. The Agricultural Extension Service is advocating lower expenditures for fertilizers and for cultivation and irrigation with the conviction that yields will not suffer. There is no general disagreement among growers who are familiar with the reduced cultivation program which is advocated as to the sufficiency of that program; nor is there marked disagreement among those who are familiar with the proposals as to the feasibility of reducing irrigation costs. Both programs are based on the research findings of the Divisions of Irrigation Investigations and Practice, and of Pomology, of the University of California, and while by no means universally applied, have been followed to an extent that makes them common in the southern coastal plain, and standard in most of the citrus and walnut sections. Agreement is less general on the proposed reduced fertilizer application, although several of the farm advisors report marked reductions in fertilizer costs as a result of the proposals advanced. The conclusion of the writers from the evidence obtained is that in periods of economic stress adjustment of costs to income without serious impairment of yields can in part be accomplished through reduction in fertilization expense—in some of the cases by \$10 to \$20 an aere, in others by as much as \$30 or \$40, and in many individual eases by much more than the highest of these figures.

Relation of costs to varying cultural needs. An array of the average costs of producing oranges in the various areas shows that the lowest costs are in areas in which the predominating variety eovered by the records is the Valencia. Averaging the six lowest "total" costs in Table 5 gives \$220, while averaging the six highest gives \$255.

¹The cultivation and irrigation practices which are counted on to reduce costs are described in University of California Agricultural Extension Service Circular 50, "Essentials of Irrigation and Cultivation of Orchards," by F. J. Veihmeyer and A. H. Hendrickson. December, 1930, revised, April, 1932.

²The annual summary of cost and yield data for 1932 issued by the California Citrus League shows a reduction of \$48 an acre in the average cost of producing oranges in 1932 compared with 1931, and a comparable reduction of \$35 an acre for lemons. While average yields for both oranges and lemons were less in 1932 than in 1931, the averages for 1932 were in both instances higher than in 1928 and 1930, in both of which years the average costs for both oranges and lemons exceeded those in 1932. This indicates that, from the standpoint of reduced costs, no significance can be attached to reduced yields in 1932.

Averaging the "totals" for lemon areas L-2, L-3, L-4, and L-5 shows an average cost for lemons of \$242, whereas the comparable orange areas (1, 3, 4, 10, 11, and 12) show an average cost for oranges of \$240, or, in round numbers, the same as for lemons.

The difference of \$35 an acre in the cost of producing Valencia and navel oranges is large enough to be significant, but the reason for it is thought to be the differences in cultural requirements between the interior zone, where navels are chiefly grown, and in the coastal zone, where Valencias predominate, rather than differences in cultural requirements of navel and Valencias.

In view of the results from the comparisons made above, differences in costs between navel and Valencia oranges and as between oranges and lemons will be ignored in the present study, except as they have to do with environmental factors.

Variations in yields. The question previously raised regarding yields was whether differences are due primarily to environmental conditions, or whether it is to be expected that the yields of different products or varieties will in the main tend to equalize as cultural practices improve.

The answer to this question seems to be that, while improvement in cultural practices will aid in narrowing the range in yields covering the bulk of the groves in any one area, environmental factors will in the long run affect yields and quality significantly with reference to the amount it is worth while to pay for water.¹

While environmental factors stand out as apparently being mainly responsible for differences in yields, and while conclusions reached in the field as to probable differences are in substantial measure confirmed by the records, the environmental factors which influence yields are so numerous, and sometimes so intricately related, that grouping the areas of the southern coastal plain for yields on the basis of any single environmental factor is warranted only in a broad way.

Furthermore, although the records presented in this report show sufficient differences to permit some grouping of areas on the basis of yields, records covering a longer period of years than those used have covered would be necessary to justify a general grouping on this basis for the purpose of measuring the value of irrigation water. However, water must have a higher value in areas of large yields than in areas of small yields, "yields" as here used taking into consideration marketability as well as quantity. Therefore, in the final conclusions in this report with reference to considerations governing expenditure for irrigation water, such importance will be attributed to differences due to environmental conditions as the data assembled seem to warrant.

Another factor relating to yields which needs mention is the program to curtail shipments for the purpose of increasing prices. To the extent that this program is carried through, the yields to be used in computing income will be those marketed, rather than those produced. There has not seemed to be any practical method of taking this factor into consideration in the present study, although, as indicated, it can not properly be overlooked if the program is effectively adopted.

¹ It is, of course, possible that improvement in cultural practices may be greater in the high-yielding than in the low-yielding groves, in which case the tendency would be to widen the range still further than that which exists now. However, environmental factors would, it is believed, still be more important.

Residual Farm Income in Relation to the Value of Water for Irrigation.

It is clear from the preceding discussion that the value of water for irrigation is dependent on many different considerations—some physical, some economic. The data assembled relating to costs of production and yields have been presented by "areas" which take into account these different considerations to the extent found feasible in view of their complicated nature and the interrelations between them. The various tables in Chapters 11, 111, and IV, which show the amounts of the residual income above the costs of producing citrus fruits and walnuts and to a lesser extent other crops—not including the cost of water—indicate for the various areas the amounts available, under the costs and with the income set forth, to cover the cost of water, interest on the investment, and profits. There still remains the practical problem of relating this residual farm income to the value of the irrigation water needed; that is, to what farmers will find it to their advantage to pay for it.

While the portion of the residual income an individual farmer will be willing to pay for water may be more or less than it is "worth" to him when considered from a strictly business standpoint, in the long run expenditures for irrigation water which do not leave sufficient over other necessary and irreducible costs to pay interest at the going rate, or at least at a reasonable rate, on the investment necessary to establish a farm will be considered excessive. Obviously the expectation of water costs which will not leave sufficient residual income to cover interest on the necessary investment will retard the development of new lands and of additional water supplies. As to developed acreages, however, the problem—as has already been brought out—is one of maintaining existing values. In either event, the question of what a farmer will find it to his advantage to pay for irrigation water is intimately related to the farm investment, as well as to the residual income. This question will be considered further in the final section of this chapter.

An attempt to develop principles by which the residual income can be allocated as between expenditures for water, interest on the investment, and profits would involve questions of theory which it is not desired to take up in the present report. However, the matter can be approached in a practical way by following several methods of approach. Three will be outlined.

Of the first two of the methods of approach in mind, one involves assuming different expenditures for irrigation water, and determining the capitalized value of the remainder of the residual income. The other is to assume values for the land, and, after allocating sufficient of the residual income over other costs than the cost of water to meet interest on such values, to allocate the remainder of the residual income to water. Difficulties are immediately encountered in this latter method. In the first place, values of land are still "in the making"; many years may clapse before these values settle down. Furthermore, it can hardly be argued that a farmer will always find it to his advantage to pay for water all that is left after meeting the cost of production other than the cost of water and after laying aside interest on the assumed value of the farm. While it might in fact be to the advantage of the farmer to do this, such an idea has little relation to reality when the amount of income over costs and interest reaches the large figures which the

farmers' balance sheets have sometimes shown. Values of land are dependent on the amount of profits over costs and interest, as well as on whether the going rate of interest is earned. However, this method of approach is a practical one provided it is not contended that the entire residual income after paying other costs than the cost of water, and after laying aside interest on the land, represents what it is to the advantage for the farmers to pay for water. What this residual income represents is rather the amount that can be paid and still meet other essential costs, together with interest at the going rate.

A third approach to the matter of allocating the residual farm income as between water on the one hand and interest on the investment on the other is to assume that present expenditures for water are as much as it is worth while for the farmers to pay because land values have become established in accordance with such expenditures. would seem that such a procedure might lay greater emphasis on water than is warranted in view of the fact that it involves only one of a number of items of expense which are generally comparable in magnitude with the expenditure for water. This third proposal will come nearest to being true when the cost of water is very high relative to other costs. It would hardly be true when water costs are low relative to other costs, largely because other factors, both tangible and intangible, which affect value may be of more importance than water. However, the relation of present water charges to expenditures that it would be to the advantage of farmers to pay will be considered in a later section of this chapter.

Returning to the two methods of considering allocation of residual income first mentioned, it would appear that the choice as to which one can most appropriately be followed will depend on whether emphasis is to be placed on the value of the water or on the value of the land on which it is used. Since the purpose of the present report is to lay emphasis on the value of the water rather than on the value of the land, as between these two methods of approach, the second one, which starts with assumed values for the land, is followed in the further discussion of this problem, in spite of the difficulties that are encountered in using it.

In the discussion in Chapter I of the items that, in most farm economic studies, are considered costs of production (page 25), it was stated that the difficulty of arriving at values on which interest on land might be figured would rule this item out as a cost of production in the present study, even if there were not other reasons for doing so. This same difficulty arises in undertaking to attempt to allocate residual income on the basis of assumed values for the land, or at least to show what is "available" for water after meeting other costs and interest. Obviously the writers can not presume in the present report to evaluate the developed orchard lands in the southern California coastal plain. However, it is possible to assume values for purpose of illustration. and to do this without reference to whether they are exactly the values which the present growers will claim for their holdings. It is sufficient if the values taken are generally in line with informed local opinion. It is believed that those used in the analysis meet this requirement. It will not be difficult for one desiring to do so to work out allocations based on different valuations.

In setting out the amount of the residual income that is available for water with assumed values for land, it is also, of course, necessary to assume prices for the products grown.

Table 18 in Chapter II shows the residual income for each of the orange areas at f.o.b prices ranging from \$1.50 to \$3 a packed box.1 With the costs of production shown by the records assembled and adjusted to assumed price levels. Table 18 shows that there is no residual income in most of the areas, either to the grower of average residual income or to the grower with the least residual income in the upper two-thirds group, at an f.o.b. price for oranges as low as \$1.75 a packed box. At \$2 a packed box, all of the areas show a residual income to the grower of average income and all but one to the grower of least income in the upper two-thirds group. In some of the areas the residual income is substantial at \$2.25 a packed box, and at \$2.75 a packed box the minimum residual income shown is \$150 an acre. This range is considered sufficient for analyzing the data relating to oranges. With an f.o.b. price of \$2.75, production costs probably would be higher than shown in the table because with a higher prospective income, more would likely to be spent in cultural operations. With an f.o.b. price of \$1.75, costs would need to go lower if even present charges for water. with nothing for interest, were to be met.

For lemons the f.o.b. prices assumed in the analysis are \$2.50, \$2.75, \$3, \$3.25, and \$3.50 a packed box (Table 19). The prices assumed for walnuts are 18, 16, 14, and 12 cents a pound to the grower, which is 10, 20, 30, and 40 per cent below the 1927–1929 average for all grades (Table 30a). Those desiring to determine residual income available for water after paying other costs plus interest on the land on the basis of different prices can readily do so from the data presented in Chapters II and III.

In the analysis given below, only the residual income received by the average grower in the middle half of the growers is used, although in the case of all three of the principal products covered—oranges, lemons, and walnuts—the residual income to growers of least income in the upper two-thirds group of growers has been included in the tables showing residual income.

Residual Income "Available" for Water With Assumed Land Values.

Three orange areas, three lemon areas, and two walnut areas have been chosen for illustrating the amount of residual income available for water under assumed values for developed land. These areas are considered to be most fully representative of conditions in the citrus and walnut areas of the southern coastal plain as a whole. With two exceptions the largest number of records are available for these areas. While for several of the other areas the number of records assembled is not sufficient to give assurance that they fully represent the full range of conditions in such areas; in most of the areas the number that has been gathered is large enough to furnish a satisfactory basis for separate consideration.

Oranges. Table 51 presents data for orange areas 3, 7, and 10.

¹ This is equivalent to a range of 70 cents to \$2.20 a packed box to the grower, since the average cost of picking, hauling, packing, and marketing used in computing this table is 80 cents a packed box.

Area 3 covers the Tustin, Santa Ana, and Orange districts of Orange County. It is representative of the coastal climatic zone, and is mainly in Valencias. The soils are in the main deep, fertile, and of smooth topography. Frost and wind hazards are moderate. Holdings are most usually of about 10 to 15 acres, which is typical of the well developed orange districts in the vicinity of important population centers. Bare and developed land values are relatively high, as are also taxes.

Area 7 covers the Redlands, Bryn Mawr, Crafton, Mentone, and Highlands districts of San Bernardino County. This is an interior belt, with navels predominating. Both flat lands and uplands are represented, the former with recent alluvial soils, the latter with mainly the older red soils. Neither the highest nor the lowest producing sections are included. Windbreaks are not common, but over half of the area has heating equipment. Taxes are about average. Neither the highest nor the lowest land valuations in the interior zone are applied to this area. The trend is toward increased size of farm holdings, with

20 acres a typical unit.

Area 10 is the largest one set up in the study. Besides the Corona section it includes the foothill districts extending from Etiwanda, in San Bernardino County, through to Monrovia, in Los Angeles County; also the valley areas of Cueamonga, Ontario, and Pomona. All of these districts are in the intermediate climatic zone, and the soils are predominantly of recent alluvial origin. Frost conditions are average for the better citrus areas. Wind damage ordinarily is not serious, but is a problem in the vicinity of Etiwanda. Taxes are a little above the average. Holdings of 10 acres are common, although there are many of smaller size and many much larger—frequently from 50 to 100 acres or more. Values cover the usual range in the better citrus distriets, with a relatively high percentage in the upper part of the range owing to so much of the area's being in a very favorable climatic environment. While it is not desired to consider specifically the influence of residential attractiveness, the residential values in the foothill areas can not be entirely disassociated from the productive values.

TABLE 51

COMPUTED AVERAGE RESIDUAL INCOME FROM ORANGE PRODUCTION "AVAILABLE": FOR WATER WITH OTHER COSTS OF PRODUCTION ADJUSTED TO ASSUMED PRICE LEVELS, WITH ASSUMED VALUES FOR DEVELOPED ORCHARDS, AND WITH F.O.B. PRICES FOR ORANGES RANGING FROM \$1.75 TO \$2.75 A PACKED BOX:

Orange area	Number of records	Average yield, packed boxes	Assumed average values for developed	Compu over all e of water, land va	Present average annual cost of water				
		per aere³	orchards per acre ³	\$1.75	\$2,00	\$2.25	\$2.50	\$2.75	peracre
3 7 10	67 88 185	211 237 213	\$2,500 2,000 1,500	-\$146 109 104	-\$96 -52 -50	\$45 5 4	\$6 63 55	\$57 121 112	\$18 05 24 67 37 52

[&]quot;Available," but not necessarily to be allocated to water.

The average prices received by the growers are of course less than the f. o. b. prices, since the local exchanges deduct the cost of packing and marketing.

¹ For basis of assuming values, see text, page 124.

This rate is taken because it is the one customarily expected by the growers.

Lemons. The illustration for lemons is presented in Table 52. The three lemon areas chosen are L-2, L-3, and L-4. This selection eliminates the one in which costs of production are lowest and the two in which they are highest. The districts covered are mainly in the intermediate climatic zone, in which most of the lemons are grown at the present time.

Area L-2 covers the principal San Diego County citrus districts, excepting Chula Vista and National City; that is, El Cajon, Escondido, Vista, and Fallbrook. Average yields are fourth from the highest in the six lemon areas, a high percentage of summer fruit being a

feature. Only 15 records are included.

Area L-3 covers the lemon districts of Orange County, together with the Whittier district in Los Angeles County, mainly in the coastal climatic zone. The lemon plantings are around the upper rim of the coastal plain. The average yields for the 90 records are comparable with lemon yields in the large intermediate-zone orange areas of Los Angeles County.

Area L-4, with 98 records, is a distinctly favorable lemon area, with average costs third from the highest and average yields slightly under the highest. This area is within orange area 10. The records come mainly from the Corona, Etiwanda, Alta Loma, Uplands, and Claremont districts. Average taxes are the highest of the six areas, but practically the same as in lemon area L-3.

TABLE 52

COMPUTED AVERAGE RESIDUAL INCOME FROM LEMON PRODUCTION "AVAILABLE": FOR WATER WITH OTHER COSTS OF PRODUCTION ADJUSTED TO ASSUMED PRICE LEVELS, WITH ASSUMED VALUES FOR DEVELOPED ORCHARDS, AND WITH F.O.B. PRICES FOR LEMONS RANGING FROM \$2.50 TO \$3.50 A PACKED BOX:

Lemon area	Number of records	Average yield, packed boxes	Assumed average values for developed	Computover all columns of water, land va	Present average annual cost of				
		per aeres	orchards per acres	\$2.50	\$2.75	\$3.00	\$3.25	\$3.50	water per acre
L-2 L-3 L-4	15 90 98	170 155 238	\$1,200 1,400 2,000	-\$79 -108 -72	\$39 72 20	\$0 - 36 40	\$39 1 79	\$78 38 158	\$23 93 22 24 49 82

[&]quot;Available," but not necessarily to be allocated to water.

The average prices received by the growers are of course less than the L.o. b. prices, since the local exchanges de-

duet the cost of jacking and marketing.

For basis of assuming values, see text, page 124.

This rate is taken because it is the one customarily expected by the growers.

Walnuts.—(Table 53.) The two walnut areas used for an illustration are W-2 and W-3, which have the lowest and highest average yield shown by the records, and which well illustrate the range in profitableness in the southern California walnut industry.

Area W-2 embraces the Chino, Pomona, Puente, West Covina, El Monte, Whittier, La Habra, and Rivera walnut districts. Chino is in western San Bernardino County, La Habra is in the northwestern corner of Orange County, and the other districts are in southeastern Los Angeles County. The soils in these districts are deep, well drained, and in the main of medium texture. The districts farthest from the

coast have summer temperatures sufficiently high to affect quality adversely.

Area W-3 covers the intermediate and coastal districts of Ventura County: that is, the Santa Paula, Saticoy, Ventura, and Santa Rosa Valley districts. Most of the records are from Santa Paula and Ventura. This is a high-yield and a high-quality area, and shows the highest average total returns to the growers, but not the highest costs. Average costs, however, are not significantly different in areas W-2. W-3, and W-4, but average about \$20 an aere less than in area W-1.

TABLE 53

COMPUTED AVERAGE RESIDUAL INCOME FROM WALNUT PRODUCTION "AVAIL-ABLE" FOR WATER WITH OTHER COSTS OF PRODUCTION ADJUSTED TO ASSUMED PRICE LEVELS, WITH ASSUMED VALUES FOR DEVELOPED ORCHARDS, AND WITH DIFFERENT NET AVERAGE PRICES TO THE GROWERS FOR WALNUTS

Walnut area	Number of records	Average yield per acre, pounds	Assumed average values for developed orchards per acre ²	over all co the co 6³ pe with ne of 18,	average residusts of products of water, a creen on asst prices to the 16, 14 and 12 and 40 per cen average for	ring walnuts and over inter umed land va- e growers for cents a pour t below the 1	other than cest at slues, walnuts ad (10,	Present average annual cost of water per acre
				18 cents	16 cents	14 cents	12 cents	
W-2 W-3	51 12	736 1,689	\$900 1,500	\$39 167	\$14 130	-\$11 94	—\$36 57	\$12 83 14 32

^{1 &}quot;Available," but not necessarily to be allocated to water.

Conclusions Regarding the Relation of Residual Income from Citrus Fruits and Walnuts to Charges for Irrigation Water.

The preceding discussion and tables relating to residual income "available" for water after meeting all costs of producing citrus fruits and walnuts other than the cost of water, and after allowing for interest on the value of developed orchards, lead up to the following conclusions:

1. The cost-of-production, yield, and income approach furnishes a reasonably reliable basis for determining the facts, on the production side, which are needed to bring out what it is to the advantage of farmers to pay for irrigation water. The data presented reflect within reasonable limits of accuracy the amounts of the residual income that may be expected from the production of the principal crops of the southern coastal plain under the varying physical conditions that exist there, and with the unit prices for labor and materials assumed in the present study. However, the amounts of the residual income shown by the tables are considered slightly conservative on the farmers' side; that is, they are probably slightly less than the amounts actually received, since the services of the farmers, which are included in the costs of production, are in some instances charged for at a rate somewhat higher than paid for labor hired."

² For basis of assuming values, see text, page 124.
³ This rate is taken because it is the one customarily expected by the growers.

¹ For discussion, see Chapter I, page 26. ² See discussion in Chapter 1, page 23.

In applying the data relating to residual income "available" for water, it is essential that the different physical conditions, as far as they affect residual income significantly, be given consideration. Combining data from areas which are significantly different will lead to questionable conclusions.

2. While "what it is to the advantage of farmers to pay" is a basic consideration in measuring the value of irrigation water and therefore in determining the price that will, if necessary, be paid for it, it is the belief of the writers that the present report should also indicate the amount that can be paid for water and still leave farmers sufficient income above costs, including depreciation, to cover interest on the going value of their land and such profits, or "labor income," as are commensurate with the particular type of farming involved. It is believed that the data presented in Chapters II and III relating to residual income above other costs than the cost of water do this for citrus fruits and walnuts, when considered in connection with reasonable valuations for land and the price outlook for these products. However, in the practical application of the data, either to the matter of fixing rates to be charged for irrigation water by public utilities or other agencies having water to sell, or in reaching conclusions as to how much individual farmers or community irrigation companies, or irrigation districts, can pay for water under any given assumptions as to rate of return, land valuations, and prices for the products, costs of production are to some degree susceptible to an adjustment to prices received and that the limitations met with in assembling costs of production make them reasonable approximations rather than exact costs.

Furthermore, year-to-year fluctuations in prices received, when multiplied by yields, frequently exceed the amounts paid for water, so that attempts at refinement in estimating the amounts that will be "available" in the future to pay for irrigation water may be misleading.

The illustrations presented in Tables 51, 52, and 53 show that, even with the residual income above other costs than the cost of water determined, the practical interpretation of the data still presents some difficulties because of the wide range of assumptions possible with reference to land valuations and rates of return on the investment.

For instance, Table 51, relating to oranges, and 52, relating to lemons, indicate that at an f.o.b. price of \$1.75 a packed box for oranges and \$2.75 to \$3 a packed box for lemons, the grower with average residual income in the areas cited can not earn interest at the going rate on valuations which it is not unusual for farmers to claim for their orchards, even if nothing is paid for water, unless, of course, it is found possible to make substantial reductions in the cost of production. On the other hand, at an f.o.b. price of \$2.50 a packed box for oranges and \$3 to \$3.25 for lemons, the grower with average residual income can in most cases earn interest on these valuations and in addition pay from \$40 to \$50 an acre for water. If the higher prices mentioned can be considered a reasonable expectation for the future, a water development project involving average annual charges to the grower for water of \$40 to \$60 an acre, with anticipated land valuations equal to those assumed, would ordinarily be considered economically feasible, provided, of course, the cultural advantages of the land to be served are equal

to those in the areas from which these rates have been computed. On the other hand, if the reasonable expectation is that over a period of years the f.o.b. price for oranges will be only \$1.75 and of lemons only \$2.75 or less a packed box, the project would be economically feasible only at very much lower land valuations or with very much lower payments for water by the growers, or both. This question, however, is considered more fully in the last section of this chapter.

In one of the walnut areas referred to in Table 53, the grower of average residual income can earn interest and pay the present average water charge with walnuts at 16 cents a pound, while in the other area the grower of average residual income can earn interest and pay more than three times the present water charge with walnuts selling at 4 cents a pound less. With water costs and yields similar to those in walnut area W-2, charges for water of, say, \$30 to \$40 an acre can be paid with walnuts selling at 18 cents a pound and still give the farmer a return of 6 per cent on a land valuation of \$900 an acre, whereas at 16 cents a pound, only \$14 can be paid for water and earn the same interest. With yields and land valuations similar to those found for walnut area W-3, more than \$160 an acre could be paid for water and still leave a return of 6 per cent on a land valuation of \$1,500 with walnuts at 18 cents a pound, and at least \$50 could be paid with walnuts at 12 cents a pound.

It thus seems clear that in using data relating to residual income as a basis for, or as an aid to, conclusions as to what expenditures farmers are justified in making for irrigation water, in any given area, both the price outlook and the values it is sought to maintain for the land irrigated are factors which require equal consideration with data relating to residual income.

VALUE OF WATER FOR DECIDUOUS FRUITS, GRAPES, FIELD CROPS, AND TRUCK CROPS

In discussing Chapter I the crops considered in the present study, it was stated that it has been possible only to consider the problem of water value and costs for truck crops, alfalfa, and field crops other than beans and sugar beets, on the basis of what growers are now paying and what has been found to be reasonable elsewhere; also, that the same approach has been necessary in part for deciduous fruits, beans, and sugar beets. The amounts being paid for water for such crops in the southern California coastal plain are given in some detail in Chapters IV and V and such information as the writers have been able to collect relating to cost of production, yields, and income for these crops is presented in Chapter IV, Tables 31, 32, 33, and 34.

But little more relating to the value of water for irrigation for these crops than is presented in Chapter IV can be added in the present chapter.

As shown in Chapter IV, deciduous fruits, grapes, and field and truck crops are in the main grown in the southern California coastal plain in areas where the cost of water for irrigation is much less than for eitrus fruits and for walnuts; that is, they are grown mainly farther down the slopes where pumping lifts are less.

The only information that has been assembled as to residual income from deciduous fruits over other costs than the cost of water relates to apricots in Hemet Valley and is presented in Table 22. The range for the 10 records was from about \$35 to over \$400 an acre, but the records are for the high-price years of 1926 to 1929. The average cost of water ranged from about \$13 to about \$20 an acre, and while no attempt has been made to adjust the cost-of-production data to lower price levels, or to consider in detail prices that may be anticipated for apricots, it would seem that the average cost of water shown by these 10 apricot records is high enough to raise a question as to the ability of many of the aprieot growers to pay it under probable future prices for the fruit. without jeopardizing land valuations that it is customary to assume. On the other hand, this average charge would not be a serious handieap in the good deciduous fruit areas. Somewhat lower average water costs for deciduous fruit as shown by table 37 for the Moorpark district and by Table 38, under one mutual water company, for the Ontario district, but about the same charge is shown by Table 38 for another Ontario mutual water company chiefly irrigating deciduous fruits: and materially higher and lower costs in deciduous fruit areas are listed in the summaries at the end of Chapter IV.

In most deciduous fruit sections of northern and central California costs of water are generally lower than shown by Table 31, although there are some notable exceptions to this statement, such as Santa Clara Valley, in Santa Clara County, and parts of southern San Joaquin Valley where there has been marked recession in the ground

water table.

In a previous study by the writers of "permissible" irrigation costs in upper San Joaquin Valley. The conclusion was reached that \$7.50 an acre would be an appropriate charge to assume for water for deciduous fruits in that area in considering the proposed State water plan. The deciduous fruit chiefly in mind was peaches. For the deciduous fruits principally grown in the southern coastal plain—peaches and apricots—expenditures for irrigation water may be expected to exceed this figure. It is considered doubtful that additional areas will be brought into deciduous fruits in southern California if the contemplated annual cost of irrigation water should exceed \$10 or \$12 an acre.

No predictions are ventured in the present report as to the value of water for the irrigation of grapes. The considerations which will most largely govern appear to be the demand for grapes for wine-making and the ability to produce table grapes of a high quality, such, for instance, as the Muscats of the Escondido district. It is believed a safe assumption that irrigation water will have a value for grapes in the southern coastal plain approximately equal to its value for deciduous fruits.

As indicated in Chapter IV, the most important field crops grown in the southern coastal plain are beans (chiefly large limas) and sugar beets. Table 31, giving 10 records for lima beans in Orange County, shows residual income above total production, harvesting, and over-

¹ State of California, Department of Public Works Bulletin 34, "Permissible Annual Charges for Irrigation Water in Upper San Joaquin Valley," by Frank Adams and Martin R. Huberty. 1930.

bead costs, not including the cost of water, ranging from \$42 to \$126 an acre, but these records mostly covered the years of high prices. Table 33, presenting 29 lima-bean records for Ventura County in 1929, shows an average difference of \$92 an acre after deducting the cost of irrigation and of about \$50 when the average association net price to the growers for lima beans for 1919 to 1931 is substituted. However, using a price of \$3.81, which was the average net price to the growers for 1931, there is an average deficit of \$14. Costs of water shown by Table 31 for Orange County average only \$3.08 an aere, with a maximum of \$5.78. The average total irrigation cost, which included labor of application, for the Ventura County records was \$9.42, with a maximum of \$24.63. However, Table 43 in Chapter VI shows frequent instances in which costs of water for beans exceed \$20 an acre and one case in which it was approximately \$34 an acre, during the year 1928. The average annual water costs given in this table ranged from \$10.73 to \$16,64.

The lima-bean industry in the southern coastal plain is recognized as being a profitable one where conditions are favorable. It does not appear from the data that the cost of water has been a material factor

in keeping farmers in or out of the business.

The data presented in Chapter IV relating to sugar beets show that this crop has also been a profitable one, with a residual income over costs other than the cost of water above \$50 an acre. The available information, however, is meager, and the sample included in the report may not be representative of the sugar beet industry. However, the growing of sugar beets is looked upon as a profitable business in areas favorable to this crop, such as the lower portions of Orange, Los Angeles, and Ventura counties. Nothing specific has been assembled as to present expenditures for water for beets, but it would appear that they

do not in any case approach the high figures cited for beans.

No attempt will be made in this summary to reach conclusions regarding the value of water for alfalfa and truck crops other than to refer again to the data regarding present costs presented in Chapters IV and V. Unfortunately the available information regarding these crops is mainly grouped with deciduous fruits and miscellaneous crops. Alfalfa is not shown separately in any of the summaries. The cost of water in 1932 under a public utility company at Gardena, where truck crops are predominate, averaged \$18.48 an acre. Undoubtedly water will have a higher value for truck crops in the best truck crop areas than it will have for alfalfa, because of the much higher return for

southern California coastal plain.

THE VALUE OF WATER FOR UNDEVELOPED LAND

truck crops, but the writers have not assembled sufficient data relating to these crops to justify their suggesting any figures for either for the

Nothing has been brought out in the present study which indicates that different principles underlie the value of water for developed and for undeveloped land. In each case the advantage gained by using the water is the ultimate measure of its value. However, while developed land may continue in production with a charge for water so high as to leave no return for the use of the land itself in the form of interest or profits, or, in extreme cases, not even sufficient return to cover depre-

ciation, the advantage gained from the use of the water at that price may not be sufficient to encourage the development of new land. In other words, it can not be assumed that the amounts established farmers are paying for water can be safely used in working out the financial set-up of a water-development project intended to bring undeveloped lands into production. Neither can it be assumed that farmers will always obligate themselves to pay as much for water for land which they either do not yet own, or in which they have not yet made the investment necessary to bring it into production, as farmers on established land are now paying. For the purpose of the present study it seems a reasonable assumption that the investment necessary to bring new land into production is not likely to be made unless there is reasonable prospect of sufficient return above costs to maintain a value in the land equal to the investment in it, including the east of necessary improvements and equipment. New land is, of course, frequently brought into production when a careful analysis of conditions would show little prospect of return sufficient to maintain values equal to the money and effort required to establish the land in production. purpose of the present study, however, is to bring out the facts, so far as this is possible, which will indicate the charges that can be met for water when other costs and income at a given price for the products grown are taken into consideration, as well as the investment in land and improvements as far as it is desired to make this a condition to undertaking the development of new land.

While, as above indicated, charges for water being paid on developed land may not be a safe guide in planning new water-development projects, it has not been unusual to assume that they are. In order to facilitate following out this procedure in connection with the undeveloped lands in the coastal plain of southern California, in case it is desired to do so, Tables 54, 55, and 56 have been prepared.

These tables show the minimum, average, and maximum water costs for oranges, lemons, and walnuts reported by growers for which cost-ofproduction records have been obtained through the Agricultural Extension Service and the California Citrus League. The water costs under various water companies and districts given in Chapter V are not included in these tables because they are average costs for entire systems and not costs to particular farms for which residual income has been computed. In addition to the water costs reported in the costof-production schedules assembled, these three tables show the computed residual income above other costs than the cost of water for three different selling prices for each of the three products, viz: \$2, \$2.25. and \$2.50, f.o.b., for oranges; \$3, \$3.25, and \$3.50, f.o.b., for lemons; and 12, 14, and 16 cents a pound, net to the growers, for walnuts. These prices are used because they seem to be as reasonable assumptions as can be made under the present uncertain price outlook. higher or lower prices may be found more appropriate at some other Setting up the residual income against water charges now being

The present efforts of the Federal Government to bring agricultural prices generally to the levels of 1909 to 1914 might suggest to some that the average prices for those years be used in the analysis. Those averages were, for 1909-1910 to 1914-1915, Navel oranges, \$1.54; Valencia oranges, \$2.35; lemons, \$3.25; Diamond No. 1 soft shell walnuts (1909-1913), 14.6 cents.

paid facilitates reaching judgment as to whether the latter are appro-

priate for areas yet to be developed.

The data presented in Tables 54, 55, and 56 are arranged according to the "areas" for which the costs, yields, and income for oranges, lemons, and walnuts have been studied. It will be noted that the last column in each of these tables refers to the page or pages in the present report on which the undeveloped lands of the southern California coastal plain are described or listed; also that the second column indicates the location of the orange, lemon, and walnut "areas" with respect to the three main geographical divisions of the southern California coastal plain recognized in the present study and in the investigations of the Division of Water Resources to which the present study is related, namely: San Diego County, South Coastal Basin, and Ventura County.

While the orange, lemon, and walnut "areas" are set up separately, it is to be remembered that in some eases they include the same districts, or, in other words, that the orange, lemon, and walnut "areas" are not separate but in some instances overlap. Furthermore, there are some undeveloped lands in each of these "areas" which are not likely to be used for such plantings. For instance, truck erops are most generally grown in the recent alluvial bottom lands; truck and field erops on the areas near the coast and below the present citrus and walnut plantings, in Orange and Los Angeles counties; and deciduous fruits in the Yucaipa and Beaumont sections, and in some of the intermediate portions of Riverside, San Bernardino. Los Angeles, and Ventura counties. Water costs for these crops have been presented in Chapters IV and V. and residual income, so far as ascertained in the present study, in Chapter IV.

It is believed that the above tables and the brief discussion preceding them carry the matter of using costs of water on developed land as a basis for determining water charges for undeveloped land as far as it is profitable to go in the present study. The tables summarize the data relevant to this question that have been assembled; the measure and method of their application are necessarily matters of judgment

in connection with particular situations as they arise.

An individual farmer can apply the data on the basis of the residual income above other costs than the costs of water which he believes he can obtain on the land he is considering developing. The State or any other agency, when undertaking to reach a judgment as to the "economic feasibility" of a proposed water-development project, can estimate the probabilities on the basis of the water costs reported for the various areas, and on the computed residual income to the average grower in the middle half of the growers or to the grower of least residual income in the upper two-thirds group of growers, the choice depending on the degree of conservatism it is desired to exercise.

MINIMUM, AVERAGE, AND MAXIMUM COSTS OF WATER PER ACRE FOR ORANGES REPORTED BY GROWERS AND RESIDUAL INCOME ABOVE OTHER COSTS THAN THE COST OF WATER IN THE ORANGE "AREAS" OF THE COASTAL PLAIN OF SOUTHERN CALIFORNIA AT SPECIFIED F.O.B. PRICES

		Costs	Costs of water per aere as reported by growers	ere as ers	Computed	Computed annual residual income per acre above other costs than the cost of water at specified f.o.b. prices per packed box for oranges	lincome per a	ere above othe per packed bo	r eosts than th x for oranges	e cost of
Areat	Main geographical division			Mostra	\$2.	\$2.00	\$2.25	25	\$2.50	0
		III III III III III III III III III II	Average	MATERIAL	A2	B³	A 20	B³	.A.3	Ba
22 24 44 46 66 67 11 11 11 12 13 13 14 15	San Diego County South Coastal Basin Ventura County Ventura County	\$6 73 6 95 7 95 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	88.6 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5	\$59 70 70 83 83 83 83 84 84 84 85 85 85 85 85 85 85 85 85 85 85 85 85	\$4.4.6.08.8.8.6.€. \$4.4.6.08.8.8.6.€.	126 133 133 134 14 14 15 15 15 15 15 15 15 15 15 15 15 15 15	\$90 11.00 11	\$6 \$4 \$75 \$4 \$6 \$75 \$6 \$75 \$6 \$75 \$6 \$75 \$6 \$75 \$75 \$75 \$75 \$75 \$75 \$75 \$75 \$75 \$75	\$143 153 1156 1166 1141 1145 1145 1148 1148 1148 1148	\$117 103 1130 1130 1105 1105 1105 1000 87 87 87 87 87

For description of areas, see page 147, a Average for middle half of growers. Lowest in upper two-thirds group of growers. Records insufficient to justify tabulation,

MINIMUM, AVERAGE, AND MAXIMUM COSTS OF WATER PER ACRE FOR LEMONS REPORTED BY GROWERS AND RESIDUAL INCOME ABOVE OTHER COSTS THAN THE COST OF WATER IN THE LEMON "AREAS" OF THE COASTAL PLAIN OF SOUTHERN CALIFORNIA AT SPECIFIED F.O.B. PRICES

¹ For description of areas, see page 152.

² Average for middle half of growers.

³ Lowest in upper two-thirds group of growers.

⁴ No records obtained.

MINIMUM, AVERAGE, AND MAXIMUM COSTS OF WATER PER ACRE FOR WALNUTS REPORTED BY GROWERS AND RESIDUAL INCOME ABOVE OTHER COSTS THAN THE COST OF WATER IN THE WALNUT "AREAS" OF THE COASTAL PLAIN OF SOUTHERN CALIFORNIA AT SPECIFIED PRICES PER POUND FOR WALNETS NET TO THE CROWNEDS

		Costs	Costs of water per acre as	ere as	Compute	d annual resid	ual income ab	ove other costs	Computed annual residual income above other costs than the cost of water	of water
			and the name		of the state of th	placinen but	es per pound i	or wainuts net	at specified prices per pound for wainuts not to the grower	
Aren	Main geographical division	Minimun	Average	N	12 cents	nts	14 cents	nts	16 cents	nts
	ę.				A ₂	33	. N.	B3	Α.	en e
W-1 W-2 W-3	South Coasial Basin South Coasial Basin Ventura County	\$3 04 75 4 65 9 66	**************************************	\$20 53 29 19 28 29 12 08		\$23 0 116 23	\$\$ \$\$ \$\$ \$\$ \$\$ \$\$ \$\$ \$\$ \$\$	And now only and	\$72 68 220 72	\$62 24 117 622

1 For description of areas, see page 65.

7 Average for middle half of growers.

Lowest in upper two-thirds group of growers.

Only three records were assembled from area W-1. Since this number is considered too small for making generalizations, the residual incomes obtained in area W-1 have been substituted, since it is believed that the two areas are close together in the various factors which determine residual incomes shown by the three records not used were \$56 for column "A" and \$60 for column "B," at 12 cents; \$77 and \$80, respectively, at 14 cents; and \$97 and \$100, at 16 cents. If it is deemed sufficient that substantially half of the growers can meet a certain water charge and still maintain the value of their investment, the residual income to the average of the middle half of the growers will be used. On the other hand, if it is desired that about two-thirds of the growers, under a given assumed price for the products to be grown, must be expected to pay the water charge without impairment of the value of their necessary investment, the residual income above other costs than the cost of water to the grower of least income in the upper two-thirds group will be used in deciding whether the project shall be undertaken.¹

Believing, as already indicated, that costs established growers are paying for water are not necessarily a safe basis for assuming or fixing water costs or charges on land still to be developed, what the writers consider a more acceptable approach has been worked out in the four

remaining tables, viz: Tables 57, 58, 59, and 60.

These tables, instead of placing emphasis on costs of water on land already established, and on residual income at given prices, make the price which it is expected the farmers will receive for their products the basis for reaching conclusions as to what water costs will be incurred by individual farmers, what charges will be used in the financial-feasibility set-up of a proposed project, or what charges an agency with water to sell will fix.

Using Table 57 to illustrate this approach, it will be seen by reference to this table (1) that for each of the orange and lemons "areas" set up in the present study the average yields, the average costs of production, harvesting, and marketing, and the interest on the investment are given; (2) that the price per packed box which farmers must receive for their products, with annual water charges ranging, in increments of \$10, from \$10 to \$60, if they are to meet all costs and also earn interest at 6 per cent on the investment in land, trees, improvements, and equipment, are shown; (3) that the next to the last column shows the increase or decrease in price per packed box necessary for each increment or decrement of \$100 in the investment on which interest is to be earned; and (4) that the increase in price per box the growers will need to receive for each increase of \$10 in the amount of the water charge is given.

In other words, with the above method of approach, decision on the amount of the water cost to be assumed, or on the water charge to be imposed, is based first, on the yield and cost of production, harvesting, and marketing to be expected, and second, on the price it is believed growers will receive for their products.

Attention is again called to the fact that the cost-of-production and yield data for citrus fruits and walnuts presented in Chapters II and 111 and used as a basis for the various tables showing residual income do not include records from the poorer 10 to 20 per cent of the orchards. Consequently the expressions "middle half of the growers" and "growers of least residual income in the upper two-thirds group" refer only to the better 80 to 90 per cent of the growers. However, it is believed that omission of the poorer 10 to 20 per cent improves the value of the sample, since it is more representative of conditions which may be expected to prevail.

PRICES PER PACKED BOX FOR ORANGES AND LEMONS NECESSARY TO COVER THE AVERAGE: COST PER ACRE OF PRODUCTION, HARVESTING, AND MARKETING, PLUS INTEREST AT 6 PER CENT ON THE ESTIMATED INVESTMENT IN LAND, AND ON THE AVERAGE INVESTMENT IN TREES, IMPROVEMENTS, AND EQUIPMENT, TOGETHER WITH A WATER COST OF \$10, \$20, \$30, \$40, \$50, AND \$60 PER ACRE PER ANNUM

Increase in price per box necessary to cover each additional expenditure	at \$10 per acre for water	2000 2000 2000 2000 2000 2000 2000 200
Increase or decrease in price per box for each increment or decrement of \$100 in the	investment on which interest is to be earned	0 69 60 60 60 60 60 60 60 60 60 60 60 60 60
us a	09\$	00000000000000000000000000000000000000
(A) plus (B) p	\$50	######################################
to cover costs	\$40	64683169 64833 64683169 64833 64683169 64833 64683169 64833
ox necessary to cover co	\$30	836831 83
O. B.* prices per box necessary to cover costs (A) plus (B) plus a water cost per acre of	\$20	00000000000000000000000000000000000000
F 0.	\$10	######################################
Interest on investment at 6 per cent	(B)	\$56 10 635 10 635 10 62 70 68 70 68 70 69 90 70 50 70 50 70 50 70 50 70 50 70 50
Average cost of production, harvesting and marketing,	per acre (A)	\$388 392 78 350 06 339 11 341 47 340 25 388 93 388 93 389 07 425 66 398 34 390 34 552 81 552 81 556 34
Average yield, packed boxes	per acre	### 1
Area		Oranges— 2 2 3 4 4 5 6 7 8 8 9 10 11 12 12 15 15 15 15 16 17 18 18 18 18 18 18 18 18 18 18 18 18 18

Average of the middle half of the growers. 2 F. O. B, prices are of course higher than the prices received by the growers.

TABLE 58

PRICE PER PACKED BOX FOR ORANGES AND LEMONS NECESSARY TO COVER THE COST PER ACRE OF PRODUCTION, HARVESTING, AND MARKETING TO THE GROWER OF LEAST INCOME ABOVE COSTS IN THE UPPER TWO-THIRDS GROUP: OF GROWERS, PLUS INTEREST AT SIX PER CENT ON THE ESTIMATED INVESTMENT IN LAND AND ON THE AVERAGE INVESTMENT IN TREES, IMPROVEMENTS AND EQUIPMENT, TOGETHER WITH A WATER COST OF \$10, \$20, \$30, \$40, \$50, AND \$60 PER ACRE PER ANNUM

	Increase in price per box necessary to cover each additional expenditure	of \$10 per acre for water	Cents Robingtone
	Increase or decrease in price per box for each increment or decrement of \$100 in the	investment on which interest is to be earned	0 2 2 2 2 2 2 2 2 2 2 2 3 2 3 3 3 3 3 3
	rs su	098	00000000000000000000000000000000000000
	A) plus (B) pl	\$50	30000000000000000000000000000000000000
	o cover costs (er acre of	\$40	, gunnananananan 6004888646 6014886 60069 60069 60069 60069 60069
יייי ליייי לייייי ליייי לייייי ליייי לייייי לייייי לייייי לייייי לייייי ליייי ליייי לייייי ליייי לייי ליייי לייי לייי ליייי לייי לייי לייי ליייי ליייי לייי ליייי לייי ליייי ליייי ליייי לייי לייי לייי לייי לייי לייי לייי לייי לייי לי	ox necessary to cover co water cost per acre of	\$30	6 000000000000000000000000000000000000
1024	F. O. B. ² prices per box necessary to cover costs (A) plus (B) plus water cost per acre of	\$20	0,000,000,000,000,000,000,000,000,000,
	F. O. B	\$10	
	Interest on investment at 6 per cent	(B)	\$56 556 567 568 568 568 568 568 568 568 568
	Average cost of production, harvesting, and marketing,	per acre	\$364 90 277 90 327 90 295 58 386 27 301 72 314 27 407 02 495 38 426 26 427 32 426 32 621 57
	Average yield, packed boxes	per acre	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0
	Area		Oranges— 1

¹ For explanation of this group, see page 27.
² F. O. B. prices are of course higher than the prices received by the growers.

PRICES PER POUND FOR WALNUTS NECESSARY TO COVER THE AVERAGE: COST PER ACRE OF PRODUCTION AND HARVESTING, PLUS INTEREST AT SIX PER CENT ON THE ESTIMATED INVESTMENT IN LAND, AND ON THE AVERAGE INVESTMENT IN TREES, IMPROVE-MENTS, AND EQUIPMENT, TOGETHER WITH A WATER COST OF \$5, \$10, \$15, \$20, \$25, \$30, \$35, AND \$40 PER ACRE PER ANNUM

Increase in price per pound necessary to cover each additional expenditure	acre for water	Cents 0 39 0 69 0 28
Increase or decrease in price per pound for each increment or decrement of	investment on which interest is to be earned	Cents 0 47 0 83 0 34
	\$40	Cents 15.4 21.4 10.1
	\$35	Cents 15.0 20.1 9.8
Price per pound necessary to cover eosts (A) plus (B) plus a water cost per aere of	\$30	Cents 14.6 20.0 9.5
over eosts (A) per aere of	\$25	Cents 14.2 19.4 9.3
necessary to cover costs water cost per aere of	\$20	Cents 13.9 18.7 9.8
rice per pound	86 10	Cents 13.5 18.0 8.7
4	\$10	Cents 13.1 17.3 8.4
	. r.c.	Cents 12.7 16.6 8.1
Interest on investment at 6 per cent	(B)	\$64.50 46.50 66.00
Average cost of production, harvesting, and	per acre?	\$93 38 68 95 72 37
Average pounds yield, per aere,		1,284 726 1,764
Area		W-1. W-2. W-3.

Average of the middle half of the growers.

Production costs reduced 25 per eent over average 1927-1929 prices.

TABLE 60

PRICES PER POUND FOR WALNUTS NECESSARY TO COVER THE COST PER ACRE OF PRODUCTION AND HARVESTING TO THE GROWER OF LEAST INCOME ABOVE COSTS IN THE UPPER TWO-THIRDS GROUP! OF GROWERS, PLUS INTEREST AT SIX PER CENT ON THE ESTIMATED INVESTMENT IN LAND AND ON THE AVERAGE INVESTMENT IN TREES, IMPROVEMENTS, AND EQUIPMENT, TOGETHER WITH A WATER COST OF \$5, \$10, \$15, \$20, \$25, \$30, \$35, AND \$40 PER ACRE PER ANNUM

Increase in price per pound necessary to cover each additional expenditure	of \$5 per acre for water	Cents 0.44 0.74 0.33
Increase or decrease in price per pound for each increment or decrement of serious \$100 in the	investment on which interest is to be earned	Cents 0.53 0.89 0.40
	<u> </u>	Cents 16 83 23 65 11 92
e e	\$35	Cents 16.39 22.90 11.58
plus (B) plus	\$30	Cents 15 95 22.16 11 25
Price per pound necessary to cover costs (A) plus (B) plus a water cost per acre of	\$\$ 50 50	Cents 15 50 21.41 10 92
Price per pound necessary to cover costs (A	\$20	Cents 15.06 20.67 10.58
rice per pound	\$15	Cents 14.62 19.93 10.25
T	\$10	Cents 14 17 19.18 9 91
d	84b 7C	Cents 13.73 18.44 9.58
Interest on investment at 6 per cent	(B)	\$64 50 46 50 66 00
Average eost of production, harvesting, and marketing,	per aere?	\$85 25 71 40 71 52
Average pounds yield, per aere,		1,127 672 1,498
Area		W-1. W-2. W-3.

¹ For explanation of this group, see page 27.
² Production costs reduced 25 per cent over average 1927-1929 prices.

While, as frequently brought out in the preceding pages, the data on eosts of production assembled in the present report, and used as the basis for the above and the preceding tables, are to some extent the result of estimates, and to a certain extent subject to adjustment to eultural requirements and market conditions, they are believed to represent with substantial correctness the amounts growers will spend in producing and marketing oranges, lemons, and walnuts; that is, with the selling prices for the products grown falling within the ranges used in making up Tables 54, 55, and 56, and shown in Tables 57, 58, 59, and 60 as necessary to give encouragement to the development of new plantings.

Continuance of substantially lower prices, such as those prevailing in the season of 1932–1933, would necessarily lead to sharp reductions in costs on established orchards, with inevitable elimination of many of the unprofitable plantings. Substantially higher prices than the ranges given in Tables 54, 55, and 56 would without doubt encourage higher production expenditures than indicated in the study, but there should still be a higher residual income above costs, unless, of course, the

higher prices should also lead to increased plantings.

When considering the approach to the problem of the value of water for undeveloped land provided in Tables 57, 58, 59, and 60, there may be objection by some that the expectation of earning interest on the capital investment should not be set up as a prerequisite to construction of water development projects for undeveloped land. On the other hand, there might be objection by others that the amounts of the investment used in the tables for computing interest to be earned are too small. There can be no fixed rule. Adjustments up or down in the investment can readily be made by applying the figures in the next to last column in Tables 57, 58, 59, and 60. The bare land values used in preparing these tables ranged from \$500 to \$800 an acre, according to the showing as to profitableness made by the data relating to computed residual income above other costs than the cost of water.

In conclusion: One of the important considerations to be taken into account in deciding on the water charges that can be applied to undeveloped lands in the coastal plain of southern California is the wide variation in the range of profitableness of the plantings. Table 17 most strikingly brings out this variation, but it is also shown by the other frequency tables in the report which relate to residual income and yields: i.e., Tables 14, 15, 28, 29, and 30. As indicated on page 39, the data assembled relating to cost of production and yields of citrus fruits are considered to be fairly representative of the upper 80 per eent of the growers, except in one area the data for which are thought to eover the full range. The figures presented for walnuts are considered a good cross section of the going orchards, not including those about to go out of production. The variations brought out in the frequency tables are thus fairly indicative of the differences that occur in the profitableness of citrus and walnut growing in the southern coastal plain. Obviously, in small areas which are reasonably homogeneous, the differences will be less marked and consequently need to be given less consideration than in larger areas.

Besides suggesting the need of eaution when considering the water charges that are to be placed against undeveloped land in any proposed new project, the variations indicated by the frequency tables, as well as the variations in the residual income to the average grower in the middle half or to the growers of least residual income in the upper two-thirds group shown especially by Tables 18, 19, 30a, and the last ten tables presented, will perhaps be of practical interest to individuals without previous experience in orange, lemon, and walnut growing who contemplate purchasing either developed or undeveloped citrus or walnut lands. It is thought to be to their advantage that, in advance of investment, they seek to make an appraisal of the position in the range of profitableness their particular proposed farm enterprises are likely to have. In making such an appraisal the descriptions of the principal physical characteristics which so largely govern production and profitableness in the various "areas" presented in the appendix, as well as the brief outlines of the economic outlook for the crops chiefly considered, given

in the earlier parts of Chapters II and III, may be helpful.

Although it has not been possible in the present study to consider in much detail the eosts, yields, and prices which in the end determine the profitableness of the deciduous fruit, vine, truck, and general farming industry in the coastal plain of southern California, the data presented in Chapters IV and V will be of assistance in arriving at judgments. It is clear that the value of water for these crops is governed by the same principles that underlie its value for citrus fruits and walnuts. No practical basis for separating its value from the value of the land on which it is used has been established, and to attempt this has not been one of the purposes of this report. Obviously the amount to be paid for water can not exceed the difference between other necessary costs and the price received for the products grown. unless, of eourse, capital investment is to be sacrificed. The costs of labor and materials are largely fixed in the general markets and are therefore not appreciably affected by action of individual farmers. Therefore, the amount one considering the development of new land is likely to obligate himself to pay for water will depend largely upon the price he will have to pay for such land and on the cost of bringing it into production. If the one who is to develop the new land already owns it, the amount he is likely to obligate himself to pay for water will be determined largely by the added net value of the production which will be obtained by irrigating it. In no case will it be to the advantage of the farmer to pay more for the water than such added net value of the production. It is entirely conceivable, however, that under conditions of water searcity and land surplus, water will be taken for undeveloped land at such a high price as to leave little value in the land on which it is used beyond the cost of improving it; or, in other words, that the eost of water will largely determine the amount that will be paid for or be invested in the land, rather than the cost of land and the cost of improving it largely fixing the price that will be paid for the water. This tendency for the cost of the water to be the determining factor in the value of land is, in fact, already apparent in the coastal plain of southern California, but consideration of this matter is outside of the immediate objective of the present report.

APPENDIX



APPENDIX

LOCAL AREAS IN THE COASTAL PLAIN OF SOUTHERN CALIFORNIA COVERED IN STUDY OF VALUE AND COST OF WATER FOR IRRIGATION FOR CITRUS FRUITS1

In the division of the coastal plain of southern California into areas for the purpose of studying the value and cost of water for citrus fruits, it was found desirable to make separate groupings for oranges and for lemons. Oranges are grown throughout the citrus areas. Taken together the two principal varieties permit a wide range of summer temperatures. Navels, however, are found mainly in the interior, while Valencias do best nearer the coast. While there are several varieties of lemons, the acreage regardless of variety is found largely within the coastal and intermediate zones, the interior zone being too hot for the production of a high percentage of summer fruit.2

For both oranges and lemons, heating requirements, pest control. water requirements, and other cultural needs and practices vary with elimate, while soil type and topography influence production costs and

vields.

After making a detailed field survey, the coastal plain was divided into twenty-one orange areas on the basis of various factors mentioned in the text.³ They were later regrouped, on a climatic-soil basis alone, into fifteen areas. The elimatic zones, as described previously, are eoastal, intermediate, and interior. Differentiation was made on a soil basis between the open, recent alluvial soils and the older, more compact types.

The number of lemon areas was reduced from thirteen to seven by the same method employed for the oranges. In some cases orange

and lemon areas are practically identical,

ORANGE AREAS

Area 1 includes the inland eitrus sections of San Diego County-El Cajon, Escondido, Vista, and Fallbrook. Oranges, especially Valencias, are the predominant citrus crop. Approximate acreages of full or partly bearing eitrus fruits are as follows: lemons, 2600; Navel oranges, 1060; Valencia oranges, 4360. There are also about 3000 acres of nonbearing Valencias.

Data on acreage in crops have been secured, as a rule, from county agricultural commissioners. ² Zones are as defined by R. S. Vaile. See page 22. ³ See page 21.

¹ Data on orchard heating have been secured from Mr. Floyd D. Young, Senior Meteorologist, United States Weather Bureau.

Soil classifications have been obtained from published soil survey reports, or from the unpublished information of the Division of Soil Technology, University of

In general, the land occupied by eitrus is rolling. Windbreaks and orchard heaters are not common here, about 400 acres being heated. The mean seasonal rainfall varies from 13 inches at El Cajon to 17 inches at Fallbrook.

Most of the soils have been derived from granitic rocks. In the El Cajon region citrus plantings are located on the residual soils of the slopes and upon the recent alluvial soils at the rim of the valley. The largest citrus plantings are on the granitic residual soils surrounding Escondido. There are about 2500 acres of young avocados near Vista. Fallbrook, located near the northern boundary, is surrounded by a large body of good soil. The acreage in citrus is not large, however, as the developed water supply is small.

The practice of fumigating every other year in the southern part of the area and every third year in the northern part has given good results in the control of scale. One spraying during the nonfumigating

years is required to control red spider.

Within this area is found the largest percentage of good, undevel-

oped soils in San Diego County.

Most of the area is served by gravity water, the Fallbrook district being the main exception.

Area 2, embracing the Arlington, Riverside, and Highgrove districts, is an old eitrus section in the interior climatic zone. Navels rank first and Valencias second, while lemons occupy only a small percentage of the acreage.

About 40 per cent of the citrus acreage has heating equipment. Seasonal rainfall varies from 10 to 15 inches. Wind is not considered

very troublesome.

Ramona and Placentia soils, types intermediate in point of age, predominate in this area. There is, however, a considerable acreage of recent alluvial soil on the fans and plain land. It was not feasible, however, to divide the area.

Topography varies from the flat grades near Riverside to the

steep slopes of the Highgrove section.

The low and intermediate areas receive gravity water, while the

upper areas are served by pumping.

Seale is not a serious problem, one fumigation every other year seeming to provide good control. Spraying every year is required to control eitroeola scale.

Area 3 is in Orange County, covering the Tustin, Santa Ana, and Orange districts. This is within the coastal zone, where summer tem-

peratures are moderated by the ocean breezes.

While the majority of the orchards are mature, there is a large acreage of young plantings. Over 90 per cent of the oranges are Valencias. The usual distance of plantings is 25 feet by 25 feet for the older groves and 24 feet by 24 feet for the new.

The soils in the main are deep, medium-to-coarse textured, and of

smooth topography.

The frost hazard is not considered great by the growers, as only about 10 per cent of the acreage is equipped with heaters. Wind, however, does constitute a menace, approximately 4 per cent of the orchard area being occupied by windbreaks. Mean seasonal rainfall for the district is about 12 inches.

On an average, groves are fumigated or sprayed four years out of five.

Most of the area is served by gravity water.

Area 4 is adjacent to area 3 and includes the lands around El Modena, Villa Park, Olive, Santa Ana Canyon and Yorba Linda. Wider differences in soil, topography, climate, and cultural operations are found in this area than in area 3.

The first four districts named use gravity water primarily, while

Yorba Linda uses an underground supply.

The Ramona soils constitute the major soil series of this area. They occupy positions slightly above the recent alluvial soils of the Yolo and Hanford series. The main body of recent alluvial soils is in the Santa Ana Canyon.

Topography varies from a rather smooth surface near Villa Park

to a rolling surface in the Yorba Linda section.

Pest control is quite a problem over a large part of the area. Some years double treatment (fumigation and spraying) has to be resorted to in order to provide adequate pest control.

The mean seasonal rainfall is slightly under 15 inches. Windbreaks are required in order to reduce wind damage. Protection

against frost is limited to about 2 per cent of the orchard area.

Area 5 includes the Garden Grove and Anaheim districts. Garden Grove is relatively a young orehard section while the major portion of the Anaheim groves are fully mature. Valencias constitute approximately 95 per cent of the citrus acreage.

The soils are recent alluvials of granitic origin, having been deposited by Santa Ana River. They are of medium to coarse texture.

Flat topography is characteristic of most of the area.

The weather bureau does not report the rainfall for Anaheim. Records given in the Anaheim soil survey report, however, indicate a slightly higher rainfall than Santa Ana.

Windbreaks are not common on the west side of Santa Ana River, even though severe winds occasionally occur. About 2 per cent of the

acreage is protected against frost.

The pest control program is about the same as that outlined for area 3.

Gravity water serves most of the Anaheim district, while the

supply of the Garden Grove district is pumped by individuals.

Area 6 lies to the northeast of area 5 and comprises the Fullerton and Placentia districts. Large acreages of young citrus are found in this old established citrus section.

Most of the old plantings are on the flat lands and adjacent slopes.

while the new plantings have extended back onto the hills.

Soils of medium to coarse texture deposited by Santa Ana River are found along the southern boundary of the area. Yolo series of soils (recent alluvials derived from sedimentary rocks) are found adjacent to the soil described above. Ramona soils occupy the positions farther up the slopes.

Valencias predominate, with over 90 per cent of the acreage.

Less than 3 per cent of the orange acreage is provided with heaters.

The city boundaries of Fullerton include many of the orchards of the district. The Placentia district receives its water by gravity from an old water company.

Pest control measures are similar to those described under area 3.

Windbreaks are not common in this area.

Area 7 includes Bryn Mawr, Redlands, Crafton, Mentone, and Highlands, in San Bernardino County. This area is within the interior zone, where high summer temperatures prevail. Navels predominate, the approximate distribution of citrus fruit acreage for the area being Navels, 70 per cent, Valencias, 25 per cent, with small acreages of

lemons and grapefruit.

Wide variations in soil and topography exist within this area. Two rather broad soil groupings can be made—the recent alluvial soils of the flat lands and the older red soils of the upland. Within the first group are the Hanford and Tujunga series. Both are soils derived from granitic rock, the latter being a little younger and usually a little coarser than the Hanford. The Placentia soils, which are locally known as the red soils, have been described under other areas. Elevations vary from around 1050 feet, adjoining Santa Ana River, to 1800 feet, southeast of Redlands.

Gravity water serves the major part of the area. Pumped water supplies the section around and to the north of Bryn Mawr.

Redlands reports a mean seasonal rainfall of 14.8 inches.

Windbreaks are not common in this area. Over half of the acreage has heating equipment.

This is an old citrus section, the major part of the trees being at

least 35 years of age. Ninety trees per acre is the usual planting.

Scale troubles are not bad. Thrips, however, cause more trouble than in the coastal belt.

Area 8 includes the high-quality districts of East Highlands and Greenspot. This is a very favorably located area with respect to wind, pest control, and yields. Frost conditions are more severe in the Greenspot district than in East Highlands. Unlike most of the areas, the land holdings are in large units.

The soils of Greenspot are largely Placentia, while those of East

Highlands are mainly Hanford and Ramona.

Approximate ranges in elevation are from 1300 feet to 2000 feet in the East Highlands district, and from 1800 to 2600 feet in Greenspot.

Area 9 includes the Rialto-Fontana-Bloomington district. Some very old plantings are found in the eastern part of the area, while the development around Fontana would be considered new.

Representative cost-of-production and yield records were not avail-

able for this area.

About half the citrus acreage is devoted to navels, one-quarter to Valencias, one-tenth to grapefruit, and the remainder to lemons and miscellaneous citrus fruits.

The western portion of the area, in particular, is subjected to Cajon Pass winds. Because of this, about 7 per cent of the area is taken up with windbreaks.

The soils are coarse-textured and of recent alluvial origin. In

some places they have become windblown.

The topography is comparatively flat from east to west, but with a uniform rise in elevation of from about 1000 feet on the south to 2000 feet near the mouth of Lytle Creek Canyon.

Area 10. Included within this area are those citrus districts of the San Gabriel and Santa Ana valleys which lie within the intermediate climatic zone and in which the predominant soil type is of recent alluvial origin, viz.: the Corona district and the long citrus belt extending along the base of the Sierra Madre range from Etiwanda to Monrovia.

Lemon area 4 is included within this area. However, since orange trees are able to withstand wider ranges of temperature, orange area

10 includes a larger aereage than lemon area 4.

The soils on the slopes to the south of the city of Corona belong to the Yolo series. They are recent alluvial soils of sedimentary origin. Along the northern border of the area the soils are classed as Tujunga and Hanford. They are recent alluvial soils of granitic origin. A large part of the planted area on the latter soil types has been rock-cleared at high expense.

San Gabriel River cuts across the northwestern corner of the area. The wide gravel beds, adjacent to the river, are of little or no agricul-

tural value, but make excellent water-spreading grounds.

Wind damage is not a serious problem except in the northeastern part of the area, in the neighborhood of Cucamonga and Etiwanda. Approximately 70 per cent of the acreage has frost protection equipment.

Area 11. This area includes San Dimas, La Verne, Charter Oak, and Covina. While closely associated with area 10, it has some rather wide soil differences. Much of the soil in the San Dimas section is classed as Ramona, an older soil than the Hanford and Tujunga series. Although some recent alluvial soil areas are included, it has been thought advisable to place them in this group rather than with the orchards farther up the slope, in area 10. Another reason for treating this area as a unit is the fact that it was possible to secure complete 3-year packing-house yield records on individual groves, totaling an area of approximately 1100 acres. Since these records included all groves, good, bad, and indifferent, it was possible to gain some idea of the representativeness of the samples being used in this report. The relationship between the packing-house records and the cost-of-production records is shown in Plate 1, page 39.

Frost protection is provided for about two-thirds of the acreage.

The major part of the area is served by pumped water.

Lemon district 5 is included within this area. The lemon orchards are located mainly near the upper border of the area.

Area 12 lies to the south of Puente Hills and occupies parts of Los Angeles and Orange counties, and includes the La Habra. Whittier, and Rivera districts.

There are greater variations in soil and topography in this area than in any of the others described. The range is from steep slopes with heavy soils to flat grades and light soils.

Heating equipment is found on about one-fourth of the area.

Windbreaks are not common.

Area 13. Orange area 13 and lemon area 6 include the plains land lying to the west and south of Saticoy, Ventura County. Large acreages of young lemons are found here, the cool summers being conducive to a high percentage of summer fruit.

Practically no heating is done in this area south of Santa Clara River, but heaters are used for lemons on a considerable acreage to

the north of it. Windbreaks are necessary.

The soils are of recent alluvial origin, mainly of the Yolo series. The flat slopes near the lower edge of the Santa Clara River fan tend to restrict drainage. Open and tile drains are employed to lower the water table over a large part of the area adjacent to the ocean. Rather encouraging results are being secured in the reclamation of the lands that are high in total soluble salts. When adequate subdrainage is provided, much of the salt can be leached from the soil.

Unlike the citrus sections of the Santa Ana and San Gabriel areas,

the holdings are comparatively large.

Area 14. Area 14 and lemon area 7 include that portion of Santa Clara River Valley lying between Saticoy and the mouth of Sulphur Canyon; also Santa Rosa Valley. Approximately 65 per cent of the citrus acreage around Santa Paula is lemons, most of which are in large holdings. Heating equipment is provided for about two-thirds of the orehard area. Windbreaks, while not common, would be a distinct advantage.

Medium to coarse-textured soils of the Yolo series are the main

agricultural soils.

Pest control has not been a serious problem in Ventura County.

Area 15 includes the Fillmore-Piru section of Santa Clara River Valley and the Ojai and Simi Valley districts. Summer temperatures are higher than in areas 13 and 14.

Even though this area is classed as interior, the ratio of Valencias to Navels is about three to one. About half the citrus acreage in the Fillmore-Piru district is equipped with heaters. Soil conditions in Santa Clara River Valley are similar to those described under area 14.

Ojai Valley, a small detached valley in the northwestern part of Ventura County, has approximately 1000 acres of citrus, mostly oranges, near its upper end. The soils in this portion of the valley are recent alluvials of medium to light texture. Neither this valley nor Ventura River Valley have been considered in the study.

About forty per cent of the citrus acreage has heating equipment. Simi Valley lies over a range of hills to the south of Fillmore, but has somewhat similar soil and climatic conditions. Previous to 1932,

there was practically no orchard heating in this valley.

LEMON AREAS

Area L-1 is located in the southern coastal belt of San Diego County, where lemons constitute almost all of the citrus plantings. There are approximately 1800 acres of bearing lemons, the acreage of young plantings being small.

Climatic conditions seem favorable for the production of a high percentage of summer fruit, summer being the time of peak lemon demand. The mean annual rainfall is about 10 inches. Windbreaks for the protection of orchards are not common, as the damage from wind is not great. Orchard heating is not a common practice, only about 30 acres being heated. The usual pest control program consists of spraying every year and fumigating every other year.

The citrus plantings are found on the knolls and bench lands in

this area of uneven topography.

Limited in size as this area is, the soil types vary widely. The surface soils range from light to heavy texture. The subsoils are universally heavy and are often underlain at shallow depths by dense, impervious substrata. This condition makes it necessary to exercise great eare in the application of irrigation water.

In general, the climatic conditions of the area now devoted to citrus seem favorable, but the soils, in most cases, require skillful management if unfavorable soil moisture conditions are to be avoided.

- **Area L-2.** Lemon area L-2 is included within orange area 1. See description of that area.
- Area L-3. The lemon districts of Orange County, together with the Whittier district, are included in this area. Lemon plantings are found around the eastern and northern rim of the valley, mainly on the residual and older alluvium soils. The area falls mostly within the coastal zone. Approximately 10 per cent of the acreage is provided with heating equipment.
- Area L-4. While not as extensive as the orange district, area L-4 is included within the area described under orange area 10.
 - Area L-5. See description of orange area 11.
- Area L-6. See description of orange area 13. No cost-of-production records for lemons were available for this area. However, data regarding yields and returns to the growers covering 28 groves were obtained from local packing houses, and appear in Table B-1 in the appendix. One reason for setting up this area separately, even if no cost-of-production records were available, was that it probably includes the largest undeveloped potential lemon acreage in southern California.
 - Area L-7. See description of orange area 14.

TABLE A. ORANGES

AVERAGES OF INDIVIDUAL COSTS OF PRODUCTION, YIELDS, AND RETURNS TO GROWERS PER ACRE

Nott. All records fall within the period 1926-1931. Serial numbers in holdface indicate navel oranges, other orange records are for Valencias. Records for which returns to grower are not given are from the California Citrus League; others are from the enterprise efficiency studies of the Agricultural Extension Service, University of (ahifornia

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Cost	of	\$2.00 \$2.00 \$3.00	
	Depre-	\$21.00.00.00.00.00.00.00.00.00.00.00.00.00	
	Insurance	\$0 00 1 34 2 16 2 16 6 8 8 3 6 8 8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	
	Taxes	\$111.82 111.83.1 11.05.8 11.05	
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Water cost and cost of barvesling not included. Picking and haufing charges have been deducted.

TABLE A. ORANGES—Continued

AVERAGES OF INDIVIDUAL COSTS OF PRODUCTION, YIELDS, AND RETURNS TO GROWERS PER ACRE

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\$3.25.25.25.25.25.25.25.25.25.25.25.25.25.	20 10 24 25 20 10 24 25 20 10 24 25 20 20 20 20 20 20 20 20 20 20 20 20 20
\$2.52 6.55 6.55 6.55 6.55 6.55 6.55 6.55	0 1 0 0 0 0 1 0 0 1 1 0 0 1 0 1 0 1 0 1
\$65.54 \$65.54 \$7.00	\$32 532 532 533 533 533 534 534 534 534 534
\$74 71 78 05 78 05 78 05 78 05 78 05 70 05 7	\$4.50
\$156 08 156 25 156 27 165 61 165 61 177 28 186 89 197 50 191 50 191 77 201 12 201 12 201 12 201 12 201 12 201 12 201 28 201 28 201 28 201 28 201 201 201 201 2	\$108
10 10 4 10 4 10 10 10 10 10 10 10 10 10 10 10 10 10	
9 15 2 17 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	20 11 28 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
218 212 217 217 217 210 200 210 211 211 211 211 220 220 220	23.27 23.27
4).0

¹ Water cost and cost of harvesting not included, ² Picking and hauling charges have been deducted,

AVERAGES OF INDIVIDUAL COSTS OF PRODUCTION, YIELDS, AND RETURNS TO GROWERS PER ACRE TABLE A. ORANGES-Continued

Returns	to grower?	\$542 91 196 12 331 14 611 61 603 75 596 27 704 55 430 18	\$204 50
Yield,	packed	160 160 171 173 173 173 173 173 173 173 173 173	88 1114 125 163
Cost	of	\$16 43 12 93 12 93 18 93 18 93 18 93 18 93 19 93 19 93 19 93 19 93 19 93 10 93	\$10.22 24.84 9.98 21.49
	Depre-	\$\$ 0.00 -	\$1 09 4 58 7 30 10 01
	Insurance	\$0 25 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.	\$2 12 1 04 25 46
	Taxes	\$3.000000000000000000000000000000000000	\$34 32 16 07 29 03 32 34
Average eosts	General	\$0.00000000000000000000000000000000000	\$6 63 6 39 10 13 12 05
A	Labor	\$52 76 70 88 88 88 88 88 88 88 88 88 88 88 88 88	\$37 81 66 58 62 96 28 09
	Material	\$83 69 10 85 10 89 31 88 931 88 931 107 85 11 92 86 17 114 79 114 79 114 79 110 72 110 72 110 72 110 72 110 72 110 72 110 72 111 83 54 112 83 84 113 83 84 114 79 115 81 116 73 117 85 118 83 84 118 84 1	\$60 81 62 35 50 00 78 90
	Total	\$187 08 187 08 187 08 194 13 194 13 195 17 197 55 197 5	\$142.78 157.01 159.67 161.85
Length	of record,	中 10 10 10 10 10 11 10 10 10 10 10 10 10	ლ ⊣ 10 10 1
	Acres	0%5 c 5 2 2 c 5 2	15 16 30
	number	250 251 252 251 253 253 254 254 254 254 254 254 254 254 254 254	271 278 258 268
	Area	Öont.)	9

977 67 729 09 381 92 472 28 472 28 689 91 689 60	
200 100 100 100 100 100 100 100	209 160 2160 216 235 117 235 235 161 1131 1121 1189 263
23.00 20 20 20 20 20 20 20 20 20 20 20 20 2	\$20 78 \$16 55 \$16 55 \$16 55 \$10 11 \$10 11 \$10 12 \$20 12 \$30 12 \$3
27-14-664-60-68-88-88-88-88-88-88-88-88-88-88-88-88-	\$7 02 \$0 14 \$0 15 15 18 0 3 09 3 09 15 18 10 48 8 99 11 63
10 0 0 1 1 1 8 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	\$1 12 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
25.5	\$34 63 20 93 19 14 40 68 20 04 35 14 11 12 16 11 4 68 11 9 30
28 25 26 27 27 27 27 27 27 27 27 27 27 27 27 27	\$12 27 \$0 71 \$0 71 1 49 12 86 12 86 7 7 42 7 7 42 7 7 42 7 85 1 43
559 48 4 72 1 8 8 8 8 1 1 1 3 2 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	\$74 91 \$19 76 54 63 54 64 63 45 64 63 27 72 82 72 82 72 82 74 004 54 16 55 16
57 64.117 64.117 65.117 66	\$39 77 56 27 67 67 68 67 62 67 67 67 68 67 68 67 68 67 68 67 68 68 68 68 68 68 68 68 68 68 68 68 68
66 65 77 77 77 77 77 77 77 77 77 77 77 77 77	\$230 67 \$96 00 132 08 146 31 149 85 151 82 155 06 156 06 156 06 157 01 179 03
	4 10 4 4 4 4 10 4 10 10 10
	200000000000000000000000000000000000000
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(Cont.)	Average 17 502 5 5 468 8 480 5 5 608 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8

¹ Water cost and cost of harvesting not included.
² Picking and hauling charges have been deducted.

AVERAGES OF INDIVIDUAL COSTS OF PRODUCTION, YIELDS, AND RETURNS TO GROWERS PER ACRE TABLE A. ORANGES-Continued

Returns	grower:	
Yield,	packed	28888888888888888888888888888888888888
Cost	water	25.58.58.59.59.59.59.59.59.59.59.59.59.59.59.59.
	Depre- eintion	\$11.8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8
1	Insurance	\$66666 \$600
	Taxes	20 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Average costs	General	200 200 200 200 200 200 200 200
A.	Labor	\$52 01 572 01 573 01 574 03 575 01 575 01 576 03 577 03 577 03 578 01 578 01
	Material ¹	\$25 66 88 88 88 88 88 88 88 88 88 88 88 88
	Total1	\$179 03 1779 96 181 96 181 96 181 96 182 96 183 37 183 87 183 87 184 96 185 87 185 87 185 87 186 88 187 87 187 87 188 87
Length	of record,	ים מו
	Acres	
	number	517 498 498 408 478 478 478 476 476 476 476 476 476 476 476
	Area	7 (Cont.)

23 23 23 23 24 25 25 25 25 25 25 25 25 25 25 25 25 25	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
888 888 888 888 888 888 888 888 888 88	
25 25 25 25 25 25 25 25 25 25 25 25 25 2	
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2.55	
65 68 68 68 68 68 68 68 68 68 68 68 68 68	
100 136 100 127 100	
12. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.	
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	110 110 110 110 110 110 110
522 523 523 523 523 523 523 523	549 559 559 564 564 556 556
7 (Cont.)	000

¹ Water cost and cost of harvesting not included, ² Picking and hauling charges have been deducted.

AVERAGES OF INDIVIDUAL COSTS OF PRODUCTION, YIELDS, AND RETURNS TO GROWERS PER ACRE TABLE A. ORANGES-Continued

Returns	to grower?		8
Yield.	packed	202222828282828282828282828282828282828	63 171 174 174 174
Cost	of water	\$ 200 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	27 87 38 80 23 25 34 31
	Depre-	\$ 80 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	
	Insurance	\$0.000	2 7 47 2 19 5 19 60
	Taxes	\$35	
Average costs	General	\$10 20 25 25 25 25 25 25 25 25 25 25 25 25 25	+ + 8 8 8 4 4 9 8 6 4 4 8 9 8 4 4 8 9 8 8 8 8 8 8 8 8 8 8 8
¥	Labor	\$63 01 \$63 01 \$63 01 \$64 141 \$65 22 \$65 2	57 73 66 73 75 75 8 76 82 8 82
	Materiah	\$3 60 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	
	Total	\$255 98 38 525 98 88 88 88 88 88 88 88 88 88 88 88 88	
Length	of record,	10 10 10 10 10 10 10 10 10 10 10 10 10 1	÷ 10 → 10 10 10
	Acres	0.000000000000000000000000000000000000	ე ე ო დ მე ო ∻
Ti, ao	number	557 558 558 558 558 558 558 558 554 77 77 77 76 554 554 554 554 554 554 554 554 554 55	710 647 706 671 731
	Area	8 (Cont.)	

0 b 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			5 0 1 1 1 5 6 6 8		1	9 6 9 1 9 0 1 0 1 5 2 1 4 1 5 9	9 9 8 7 9 9 9 9 8 6 6	\$ 7 7 9 6 1 9 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1 1 5 5 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1 1 2 2 3 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	2 1 2 1 2 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1			* 1 * 2 * 2 * 2 * 2 * 2 * 2 * 2 * 2 * 2	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	# # # # # # # # # # # # # # # # # # #	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	8 P P P P P P P P P P P P P P P P P P P	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			\$ 6 7 1 1 4 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	\$380.00			9 1 1 1 2 9 3 8 1	# # # # # # # # # # # # # # # # # # #	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1)	902 64	
169 215 134 117	207	233 163	198	183	120	260	S 6	200	161	151	525	194	241	220	147	281	686	192	192	2001	210	938	208	237	297	190	212	979	999	214	7 07	289	293	86
16 95 16 95 34 31 56 21																																		
5 50 5 50 2 90 10 23																																		12 01 12 68
0 0 0 78	1 80	08 29	87	1 19	0 34	34	1 80	71.	00	1 20	47	77	1 21	* 00 0 00	32	1 89	1,8	73	73	- 0.4 - 0.4	67 1	1 25	1 54	1 31	1 10	75	1 47	1 47	1 16	1 00 22 22 22	1 33	2 15	1 50	- 98 89
14 98 14 98 21 97 15 64																																		
48 48 5 93 10 48																																		
71 16 71 16 62 28 92 22	76 61 44 49	42 37 90 47	37 92 66 27	54 93	41 68 67 08	67 08	77 11	08 09	51 09	48 50	20 79	55 83	51 88 62 23	42 03	63 66	42 95 72 52	50 55	54 26	54 26	02 23	66 23	36 34	78 78	20 88	00 17	61 28	79 54	79 54	100 75	60 95	40 04	68 12	61 95	86 84 84 84
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¹ Water cost and cost of harvesting not included.

² Picking and hauling charges have been deducted.

AVERAGES OF INDIVIDUAL COSTS OF PRODUCTION, YIELDS, AND RETURNS TO GROWERS PER ACRE TABLE A. ORANGES-Continued

Returns	to grower ²		1 1 5 1 1 6 1 8 8 8	8 9 6 8 8 8 8 8	\$376.15	304 59	100	* * * * * * * * * * * * * * * * * * *	2 2 2 2 2 2 2 4	8 P P P P P P P P P P P P P P P P P P P	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0			1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	6 6 6 0 1 0 1 0 4	888		1 0 1 4 4 5 6 8 8 8	\$: : : : : : : : : : : : : : : : : : :	3 8 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6				6 6 6 6 6 6 6	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	554 17		1 1 1 1 1 1	8 1 1 1 2 3 3	2 8 8 9 9 9	0 0 0 0 0 0 1 1	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			1	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Yield,	paeked	194	191	914	322	181	100	000	022	246	212	526	293	308	100	355	305	336	616	147	06	143	219	132	149	230	342	228	178	193	315	212	225	285	180	186	181	199	277	246	236
Cost	of	8.57.7.0 0.7.7.7.0	55 55	95 69	70 00	47 00	20 07		76 60	64 73	32 92	72 26	35 20	50 65	81 44	45 03	65 98	44 55	89 69	89 69	25.05	10 94	60 75	20 97	78 28	54 74	46 06	27 01	27 04	14 60	65 98	69 9	69 9	45 00	10 7:4	10 74	38 05	38 05	61 02	62 92	24 84
	Depre- ciation		8 7.5															35 40		-																			3 32		
	Insurance		1 24		1 36	36	07	200		7 2		1 47		80	09	1.50	75.0	1 36	1.52	1 52	26	7.3	22.00	91	1 59	85	-23	1 30	- 30	1 39	1 62								1 43		
	Taxes	\$99.15	52 15	90 93	33 70	33 81	90 55	2 1 0	00 07	25 20	30 30	19 27	25 65	23 23	32 23	36 99	68 07	17 62	36 58	36 58	20.00	33 55	22 25	21 84	20 06	49 36	33 55	21 47	21 :17	17 44	10 65	- ×	78	37 73	39 18	39 18	23 36	23 36	32 75	34 72	40 93
Average costs	General		36 10													7	47 13	15 83																					12 60		
A	Labor	806 44	95 19	71 00	76 07	26 07	10 00	1000	S 2 0 0 0	F/ 00	07 70	81 61	61 58	78 24	61.87	79 62	38 10	80 76	83 91	83 91	70.98	71 08	100 13	81 31	85 13	68 13	96 22	74 28	74 47	81 33	16 98	56 61	56 61	88 95	16 62	79 94	96 35	96 35	85 30	86 95	93 41
	Material ¹	860 83	70 60	116.83	86 38	000000000000000000000000000000000000000	138 74	1000	100 10	67 401	142 (8	122 60	140 95	133 88	134 45	130 14	121 87	103 50	114 40	114 40	94.57	116 04	125 93	88 05	137 39	109 93	115 73	147 64	147 64	105 58	124 63	99 65	65 62	121 48	123 09	123 09	109 95	109 95	136 85	134 31	115 41
	Total	\$933.79	234 02	93.4 0.9	935 99	937 54	930 50	000000	00 667	242 09	243 75	244 57	245 53	250 60	251 10	253 05	253 77	254 47	256 86	256 86	258 79	259 42	260 24	261 78	263 16	264 12	264 39	264 79	264 98	265 56	267 31	268 42	268 42	268 80	269 73	269 73	270 11	270 11	272 25	274 59	275 28
Length	of record, years	4.0	24.0	10	0.00	e eri		D 84	o L	00	2	c	ro	100	ıç	, rc	200	000	10	2 4 (7	000	10	co	KQ.	aj.	rc.	c	10	10	က	ಣ	i.c	<u>.</u>		£.	ro.	20	20	20	2	c
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i ci	number	871	698	884	1043	1057	169	360	070	000	99/	695	619	756	836	626	86	1049	845	270	200	678	098	894	694	65	677	882	988	1062	29	874	875	×	846	820	739	741	998	865	159
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264	1283	341	369	221	227	234	224	261	355	181	271	322	159	986	172	199	000	209	308	327	227	233	117	271	707	203	109	193	907	930	273	211	183	199	263	196	180	195	252	330	121	260	246	212	100
52 42 20 44																																													
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¹ Water cost and cost of harvesting not included.
² Picking and hauling charges have been deducted.

10 (Cont.)

AVERAGES OF INDIVIDUAL COSTS OF PRODUCTION, YIELDS, AND RETURNS TO GROWERS PER ACRE TABLE A. ORANGES-Continued

	Length			7	Average costs				Cost	Yield,	Returns
	of record, years	Total	Material	Labor	General	Taxes	Insurance	Depre- ciation	of	paeked	to grower:
	-	6290 55	2165 15			8.18. 1.1	84.87			0.66	
	10	320 92	104 56	116 29	35 11	4.1 71	- CT	19 82	20 26	256	
	2	322 40	149 63			32 27	1 35			202	2 2 1 1 1 1 1 0 0 0 1 1 1 1 1 1 1 1 1 1
	2	323 93	156 17			20 10	2 12			192	8 8 1 1 2 8 9 9
	50	324 20	156 47			20 41	2 12			243	1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
	1 CO	325 15	150 00			19 89	1 33			310	2 2 2 2 3 4 5 5
	ı, c	327 75	138 08			32 25	000 1			916	8 2 8 8 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
	G L	07/170	150 00			24 45 25 25	67 1			0.00	8 8 1 1 1 1 1 1 1 2
	O M	222 20	150 051			22 44	7 1 -			305	1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
	O H	356 35	140 66			22 GK	9 15			173	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
2000	n w	336 57	149 63			3.9.97	1 35			239	1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
	D KC	227 56	155 05			13 52	16 7			936	8 6 6 1 1 1 0 1 0 1
	2 K	34.4.38	135 11			33 60	13.5			2016	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
	o w	244 28	135 11			33 60	2000			0000	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
		358 40	150 57			95 39	5 07			131	9
	o sa	360.87	10 691			95 39	5 07			207	8 4 4 1 3 1 5 5 9 1 1
	10	361 03	139 07			00 0+	2 05			225	
	o ru	360 95	175 55			25 65	33			340	
754 107	7	377 89	193 01			25 30	1.56			218	
	10	383 88	163 93			29 70	6 20			191	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
	10	303 000	163 93			29 70	6 20			353	
	। च	399 78	152 73			26 63	0			310	
11 0	9	8961 88	\$121.64	\$83.07	\$15.05	\$27.87	\$1.49	\$11.86	\$37.52	213	
				- 1	- 1				- 1		
	8						\$1 89	\$24.70		28	1 1 1 1 1 1
	22						30	9 50		823	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
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	20.						1 05	1 06		108	9 9 1 0 0 0 0 0 0 0
	5						66	12 83		2002	1 2 9 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
	2							9 79		747	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
	20							16 80		302	1 1 1 1 1 1
	22							16 81		170	1 1 1 1 1 1
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	\$360 32 187 10 214 13
138 306 306 317 208 198 198 198 198 198 198 198 198 198 19	232 111 177 237 237 237 111 166 166 111 351 193 265 265 265 265 27 27 27 27 27 27 27 27 27 27 27 27 27
23.23.44 23.24.44 23.24.	\$13 09 24 92 47 009 47 009 177 74 117 74 119 90 26 95 118 60 118
23 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	\$10 13 \$10 13 \$10 13 \$6 60 14 66 15 13 3 56 6 61 9 20 11 64 10 60 6 06 10 66 7 7 15 8 88 8 05
88600 2 8 8 8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	\$2 01 \$6 00 \$6 00 \$7 00 \$8 0 \$7 00 \$8 0 \$7 00 \$7 0
22 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	\$25 44 \$22 89 \$22 89 \$24 36 \$20 96 \$46 05 \$15 50 \$21 52 \$21 52 \$24 78 \$25 50 \$25 50 \$25 50 \$25 50 \$26 03 \$26 03 \$26 03 \$27 50 \$27 50 \$28 03 \$28 04 \$28 04 \$28 04 \$28 04 \$28 05 \$28 05 \$2
22 24 25 26 27 27 27 27 27 27 27 27 27 27	\$20 73 \$6 53 \$6 63 12 40 7 22 16 72 16 72 16 72 16 72 16 72 16 72 16 72 16 72 16 72 17 72 18 72 19 66 11 29 11 29 17 72 18 72 19 72 10 72
75 82 83 33 86 84 85 86 86 87 87 87 87 87 87 87 87 87 87 87 87 87	\$92 29 \$45 77 \$45 77 \$45 77 \$45 77 \$50 50 \$60 50 \$6
116 17 79 118 64 119 119 119 119 119 119 119 119 119 11	\$115 95 \$21 23 \$50 39 76 25 62 25 62 25 68 54 102 68 102 68 103 20 104 68 174 36 105 35 105 35 106 88 174 36 107 88 108 8
	\$276 57 \$114 33 \$119 19 157 07 159 89 160 13 160 13 181 83 181 83 181 83 181 83 181 83 194 95 195 65 195 65 198 94 209 61 217 43
ちゅうこうちょう あるるるるるる ちょうらん しょうしょう	# © 10 10 10 10 10 10 10 10 10 10 10 10 10
55-520% \$200% RIE% 545% RG 2 8 8 8 2 2 8 8 8 5 5 5 5 5 5 5 5 5 5 5	19.3 25.0 20.0 20.0 20.0 20.0 20.0 20.0 20.0
780 833 833 833 833 772 809 794 795 795 825 825 825 825 827 828 823 823 823 823 823 824 787 787 787 788 788 788 788 788 788 78	Average 1030 1027 11027 113 113 116 116 141 141 141 141 141 141 141 141
11 (Cont.)	. 12

¹ Water cost and cost of harvesting not included.
² Picking and hauling charges have been deducted.

TABLE A. ORANGES Continued

1025 15 6 6 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		A	Average costs				Cost	Yield,	Returns
1025 1036 10400 1056 1066 1077 1076 1077 1076	Total ¹ Material ¹	Labor	General	Taxes	Insurance	Depre- ciation	of	packed	to grower
400 401 387 432 432 433 442 443 443 443 443	76 \$78				\$1 10			210	
3871 126 136 136 136 137 148 148 148 148 148 148 148 148	227 49 89 55 337 60 115 00	99 89	15 00	20 50	980	32 92	13 41	253	1
126 136 136 136 136 136 136 148 148 148 148 148 148 148 148	33 10				00 1			100	1
148 394 394 394 456 450 451 451 451 451 451 451 452 389 307 433 397 431 431 431 431 431 431 431 431	20 118				16 0			177	# #
135 392 394 384 446 450 453 451 1028 1028 1028 1029 1029 1029 1029 1039 10	34 68				3 75			611	1 1
	89 95				1 10			115	
394 381 446 450 420 422 423 423 389 402 429 420 420 420 420 420 420 420 421 421 421 421 421 421 421 422 423 424 433 431 432 433 433 431 431 432 433 433 434 435 436 437 437 438 438 438 438 438 438 438 438	01 78				1 63			279	1 6
446 420 422 422 422 423 451 451 452 1029 423 397 433 431 431 431 431 431 431 431	55 92				2 32			197	
381 420 420 421 422 331 432 433 433 433 433 434 434 434	63 83				1 31			225	1
420 453 454 451 1028 1028 1029 410 1029 413 410 415 415 416 417 417 418 419 419 419 419 419 419 419 419 419 419	32 96				3 39			185	- 1
453 452 452 451 454 454 454 454 458 4029 403 403 410 443 431 431 431 431 433 433 433	95 100				1 52			228	- 1
407 451 454 454 454 9 1029 389 30 410 410 415 424 431 431 55 65 65 65 65 65 65 65 65 65	17 87				95			157	1 b
451 451 451 453 1029 1029 1029 1029 1029 1029 1039	99 100				10			358	1
451 452 1028 1029 3889 3879 415 415 424 431 431 55 65 65 65 65 65 65 65 65 65	81				200			182	-
1028 1028 389 1029 433 433 397 415 415 424 431 55 65 65 65 65 65 65 65 65 65	45 100							170	2 2
1028 429 389 433 410 410 410 410 410 410 410 410	06 101				2 15			239	1
389 30 433 32 410 4 410 4 415 14 450 19 431 55	92 29							707	
5 4 57 4 60 44 4 60 52 50 60 5 4 57 4 60 44 60 50 50 60 60 60 60 60 60 60 60 60 60 60 60 60	91 93				67. 7			181	1
- 67 - 6 - 5 - 6 - 6 - 6 - 6 - 6 - 6 - 6 - 6	100				- C			100	1 1
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	52 156				150			276	1
× 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	8.1				9 67			960	1 1
© 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	00 108				000			380	1
2000	30 125				7.7			202	1
in the second	93 115							23.4	f b b
00	87 159							226	1 1
28	60 159		22 76	30 29	2 00			221	
T.	92 171							280	1

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212	261	235	56	160	192	192
\$25 45	41 85	14 53 24 09	37 76	37 76	29 67	\$30 81
	28 99 28 99					\$16 55
\$0 84	4 4 17	1 22 2 61	3 88		2 91	\$2.74
	22 47					\$21 32
\$14 92	38 07 38 07	8 64 13 81	84 96	84 66 90 04	20 07	\$33 82
	79 09					891 54
	40 74					\$66 76
	213 53					\$232 71
20.40	चि	10 1	ಣ	೧೧ ಕ	o ro	4,3
1.1	17	2088	28	<u>o</u>	2001	32
916	917	930	914	943	941	Average

15

¹ Water cost and cost of harvesting not included.
² Picking and hauling charges have been deducted.

TABLE A-1

AVERAGE YIELDS AND RETURNS PER ACRE FOR ORANGES, VENTURA COUNTY, AS SHOWN BY RECORDS OF MATURE GROVES CONSIDERED REPRESENTATIVE OF THE VARIOUS AREAS BY THE FARM ADVISOR AND PACKING-HOUSE MANAGERS.

Area	Serial number	Length of record, years	Acreage	Average yield, packed-box equivalent	Average returns to grower ¹
13	1 2 3 4 5 6	5 5 5 5 5 5 5 5 5 5 5	17.6 14.0 17.2 12.5 17.0 16.9 13.5	350 349 483 118 107 159	\$1,081 58 1,064 99 1,349 67 286 62 265 20 425 34 256 42
	Average	5	15_5	246	\$698 27
14	1 2 3 4 5 6 7 8 9 10 11 12 13 14	5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	51.2 14.2 28.1 8.7 13.3 18.6 6.8 12.3 13.9 4.4 16.9 19.5 16.1 20.0 26.0	346 271 325 329 266 160 256 122 160 259 460 308 206 128 153	\$1,111 46 773 19 1,046 70 1,080 78 695 35 411 93 657 15 322 21 435 66 815 12 1,408 53 820 51 583 86 318 59 468 94
	Average	5	18 0	260	\$775 7
15	1 2 3 4 4 5 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 46 7	555555555555555555555666666666666666666	4.4 10.3 10.4 2.8 10.4 8.6 5 17.2 4.6 56.8 18.6 6.8 18.6 7.7 2.5 4.6 6.8 18.6 30 7.7 2.5 2.5 7.5 2.5 1.5 1.6 1.6 1.6 1.6 1.6 1.6 1.6 1.6 1.6 1.6	472 450 424 357 360 391 315 319 194 274 237 315 268 234 334 273 160 258 136 224 777 100 89 120 330 124 285 134 87 156 273 222 251 116 453 302 147 273 205 208 221 209 154 78 209 187 187 187 187 187 187 187 187	\$1,012 18 1,025 60 811 04 717 48 890 53 897 80 685 09 740 83 421 82 551 27 559 59 918 43 819 16 606 13 1,069 43 757 34 423 37 736 93 403 72 664 26 249 53 330 07 968 07 400 12 883 35 458 86 258 98 368 21 269 47 1,135 12 324 46
	Average	4 9	10	219	³\$467 57

¹ Picking and hauling costs, averaging 10 cents per packed box, not deducted. ² Average for 2 years only. ³ Average returns to growers for serial numbers 1 to 37, inclusive, only.

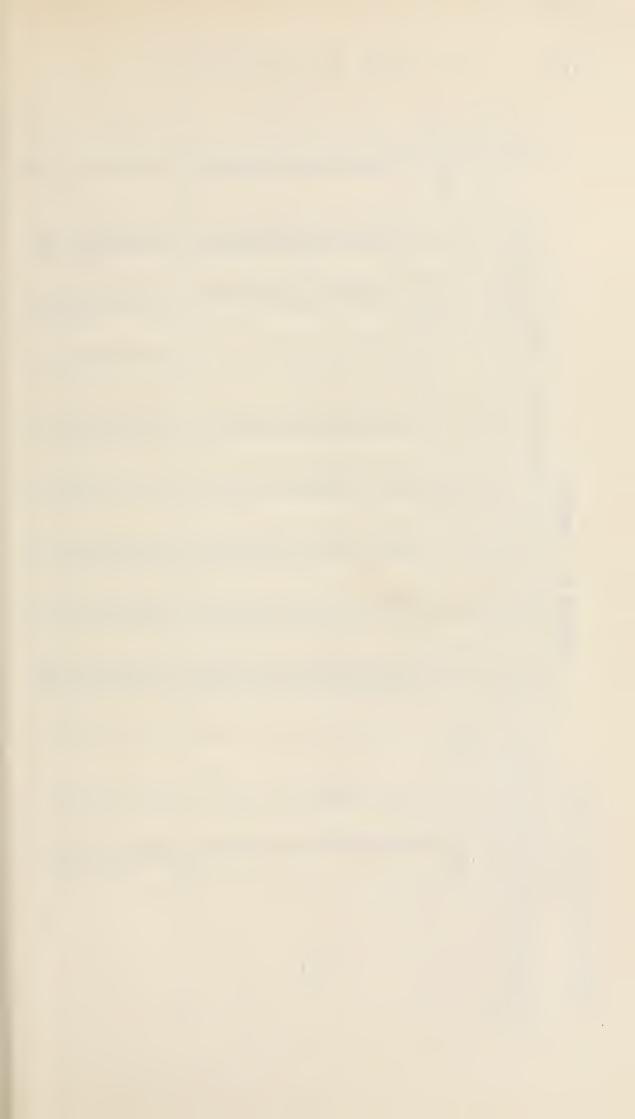


TABLE B. LEMONS

AVERAGES OF INDIVIDUAL COSTS OF PRODUCTION, YIELDS, AND RETURNS TO GROWERS PER ACRE

NOTE.—All records fall within the period 1926-1931. Records for which returns to grower are not given are from the California Citrus League; others are from the enterprise efficiency studies of the Agricultural Extension Service, University of California.

	boxes grower:	152	142	105	131	091	115	110	200	266	201	187	224	281	277	212	255	177	103	-13	61	329	264	133	150	176	100	134	172
	nf pack water box	\$22 03																\$37.18			-	-	_	7 90					
	Depre-	\$0 56				1 29	5 26	0 01	1 97	1 76	5 86	7.54	3 74	79		-4.38	1 20	\$2.71						00 °					
	Insurance	\$0 00 91			1 84		0 0	00	0	0	0	0		71	0	0	0	80 19		1 22			96	1 32	1 000	1 37	00	30.	- 000
	Taxes	\$23 96																\$22.86	\$11.18	15 82	8 20	11 87	11 02	10 82	22.8	10 10	1000	15 79	15 64
Average costs	General	\$0 00																\$15 32						30 23					
	Labor	88 24.70 20.21 20.70																\$84.98						67 88				_	
	Material ¹	\$57 557 36																\$77.39						56 49					
	Total1	\$130 72																\$203 77						169 64					
Length	of record,	10 tr	ا بند د	eo 11	010	च्युंग ।	اده ا -	O LO	-	ıs	10	22	ia	ro.	20	-	<u></u>	4.7	2	2		<u>ده</u> ا	- C		G 14	2 K	D 147		10
	Aeres	20.2								_		_						19.7						000					
S. F. C.	number	0.00	19	2 - 2	100	15			- 60	1-	_	10	17	-		~~	16	Average	4	S+	200	29.8		35	222	36	-	500	38
	Area							-	1-1														1		1				

9 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	6 6 8 8 8 9 8 9	8 8 8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	0 0 6 6 7 8 9	\$238 81	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	910 00	00 01	* * * * * * * * * * * * * * * * * * *	* * * * * * * * * * * * * * * * * * *	9 · · · · · · · · · · · · · · · · · · ·	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		395 53	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	91.9.18	OF GRA	211 85	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	* * * * * * * * * * * * * * * * * * *	8 6 1 9 6 1 6 9 8 8 8 8 8 9 9 9 9 6 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	* (733 13	9 1		1	# E E E E E E E E E E E E E E E E E E E	* * * * * * * * * * * * * * * * * * *	9 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0			* * * * * * * * * * * * * * * * * * *	0 0 0 1 1 2 0 0 0 0 1 1 1 1 2	0 10 10 10 10 10 10 10 10 10 10 10 10 10	3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
150 275 195	170	85	3 88	16	169		115	143	135	59	125	22.5	116	100	127	63	13.5	109	119 1119	161	105	00 =	601	187	95	601	010	011	109	181	145	1951	207	105
18 56 59 83 33 10	\$23 93	\$6 75 18 89																																
7 60 41 06 9 20	\$8 71	\$2 56 3 25	0 03 0 12 1 12 1 12	10 42	# # # # # # # # # # # # # # # # # # #	3 11	1 63	8 10	0 00	91 9	3 00	21 15 9 0 9 0 9 0	8 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	5 76	2 23	0 6	7 10	15 62	10 17	4 23	18 21	0 00 0 00 0 00 0 00	10 0	9 20	6 13	20 S	3 co	10 96	13 63	5 96	24 79	14 83	90 9	8 80 11 61
1 96 1 49 1 97	\$1.40	\$0 16 48		3 43	4.0	90	1 68	986	72	525	0		- FI	52	1 62	75 -	0 16	1.58	1 97	1 89	20	1 10	2 80	2 01	1 32	200	1 41	89	1 81	1 11		0 10	90	1 23
20 16 13 86 15 56	\$12.97	\$22 67 34 23																															_	19 99 17 189 1
9 50 33 27 6 73	\$12.73	\$5 20 2 06																																8 67 5 95
151 75 137 15 145 79	\$103 39	\$37.42																																75 57 94 13
100 15 78 76 130 16	\$71 74	\$44.73 34.47																																
291 12 305 59 309 41	\$210 94	\$112 77							9	23	ış l	<u>~</u> 9	219	10		: 5	000						2 %	9	œ !	23	2 15	=	22	#	93	2 ∞	=	215 55
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																	T 9	D-71																

Water cost and cost of harvesting not included.

Picking and hauling charges have been deducted.

TABLE B. LEMONS—Continued

	Returns	to grower?	981 83
	Yield,	paeked	199 199 199 199 199 199 199 199 199 199
A ACRE	Cost	of water	\$65 \$65 \$65 \$65 \$65 \$65 \$65 \$65 \$65 \$65
GROWERS PER		Depre- ciation	\$2.50 \$2.50
TO		Insurance	\$3 1. 1. 25 1.
RETURNS		Taxes	\$25 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8
AND	Average costs	General expense	\$10.00
ON, YIELI	K.	Labor	\$56 30 71 18 95 30 71 18 96 17 96 17 96 46 102 24 103 24 104 6 46 105 24 106 25 107 24 108 42 109 42 10
PRODUCTION, YIELDS,		Material	\$106 25 112 33 112 23 112 23 108 24 108 24 100 22 106 22 107 24 107 24 107 24 107 25 107 27 108 23 108 24 108 24 108 24 109 25 109 27 109 27 109 27 109 30 109 32 109 32 1
OF		Total	\$216 218 75 218 75 218 75 2219 65 2229 87 2233 31 2233 31 224 2 10 224 2 10 224 2 10 224 2 10 224 2 10 224 2 10 225 2 11 225 2 11
OF INDIVIDUAL COSTS	Length	of record, years	10 10 10 10 10 10 10 10 10 10 10 10 10 1
F INDIVI		Acres	33 20 20 20 20 20 20 20 20 20 20 20 20 20
AVERAGES C	13:00	number	2391 2391 2287 2287 2287 2287 2287 2287 2287 228
AVI		Area	L-3 (Cont.)

	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6
250 215 215 238 271 431 266 206	155	123	343
23 10 25 24 20 89 33 34 16 43 40 49	\$22 21	28	
13 71 15 56 17 48 17 48 11 38 29 02 30 18	\$10.44	\$654021114886444714464646464646464646464646464646464	
81 65 1 65 1 65 1 65 1 65 1 65 1 65 1 65	\$1 16	\$0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1 27
22 23 25 25 25 25 25 25 25 25 25 25 25 25 25	\$26 05	\$4475980110803045888888888888888888888888888888888	-
18 30 13 41 13 41 24 96 27 19 26 45 8 34 27 31	\$12.62	\$\$ \$\$ \$\$ \$\$ \$\$ \$\$ \$\$ \$\$ \$\$ \$\$ \$\$ \$\$ \$\$	-
134 19 109 51 162 18 143 06 135 18 160 89	\$80 1.1	8.0.2.0.2.0.2.0.2.0.0.0.0.0.0.0.0.0.0.0.	-
120 28 153 50 91 30 105 98 123 94 175 21 150 97	\$86 50	\$67 \$67 \$67 \$67 \$67 \$67 \$67 \$67	-
311 00 316 59 326 22 334 19 345 95 377 66	\$222 90	\$137 \$137 \$137 \$137 \$137 \$137 \$137 \$139 \$1	
	8.4	40000040400000000000000000000000000000	
~ w ∞ ₹ w v v ~	13.8	0450x4054x6052x000575200050054257111454756	- 8
137 414 393 380 150 448 449	Average	607 663 663 6645 665 709 709 709 709 709 709 645 6645 6645 6645 6645 6645 6645 6645	662
,		I-4	

Water cost and cost of harvesting not included.
Picking and bauling charges have been deducted.

AVERAGES OF INDIVIDUAL COSTS OF PRODUCTION, YIELDS, AND RETURNS TO GROWERS PER ACRE TABLE B. LEMONS-Continued

Returns	to grower ²	\$759 04
Yield,	packed	232 232 232 233 233 233 233 233 233 233
Cost	of	\$6.50 \$6.50
	Depre-	**************************************
	Insurance	0,
	Taxes	\$\frac{1}{2} \frac{1}{2} \frac
Average costs	General	25
V	Labor	\$25
	Material	\$ 10.00
	Totalı	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
Length	of record,	ර අත ර ර අත ර ර ර ර ර ර ර ර ර ර ර ර ර ර
	Acres	
	number	690 697 697 698 698 698 698 698 698 698 698 698 698
	Area	L-4 (Cont.)

1,058 20	3 3 4 1		
# 24 & B = 24 & B & B & B & B & B & B & B & B & B &	238	73 135 135 124 107 107 101 120 120 120 131 131 131 131 131 131 131 131 131 13	
644 706 706 706 706 706 706 707 708 708 708 708 708 708 708	\$49 82	\$3.00 \$3	\$35 55 55 12 12 23 13 13 13 13 13 13 13 13 13 13 13 13 13
25.22 12.522 12.522 14.6833 14.6552 16.014 16.014 17.02 17.03 17.0	\$11.27	\$1 21 6 35 8 59 9 44 112 94 113 94 114 82 115 82 117 50 117 50 117 50 117 50 117 50 117 50 117 50 117 50 117 50 118 82 119 8	\$7 72 10 73 14 65 35 96 32 52 14 52 28 53 \$23 51
2 1 2 2 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	\$1 34	\$0 0 0 7 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	\$2 78 2 78 2 78 2 96 4 99 4 10 5 10 5 10 5 10 5 10 5 10 5 10 5 10 5
19 50 51 52 52 53 53 55 54 55 55 55 55 55 55 55 55 55 55 55	\$26 22	\$17 20 15 37 16 40 16 62 16 62 23 29 22 29 69 27 77 27 27 77 27 27 77 27 27 77 27 27 77 28 68 29 68 29 68 20 68 20 68 20 77 77 20 77 77 77 77 77 77 77 77 77 77 77 77 77	\$14 13 23 72 17 36 23 06 20 54 26 65 26 65 28 65 29 65
29 12 119 57 119 57 119 57 119 57 119 57 119 66 119 66 119 69 119	\$16 59	\$0 00 2 58 2 58 31 47 42 43 42 43 42 43 44 11 45 10 46 11 47 47 47 68 48 47 48 47 48 4	\$30 34 53 48 65 00 65 00 67 65 67 65 63 95 856 73
140 01 123 14 81 81 124 60 126 09 113 43 119 98 87 00 107 29 118 81 124 57 107 29 118 81 121 45 102 16 104 12 104 12 104 12 104 12 104 12	\$86 51	\$45 48 98 32 78 57 77 8 57 77 8 57 100 18 78 76 65 35 106 83 106 83 84 91 66 05 1153 97 107 27 107 27 107 27 107 27 107 27 107 27 107 27 108 88 86 73 141 66	\$95 08 95 86 95 86 93 19 158 71 104 74 116 30 163 14 \$118 15
131 82 143 76 177 77 177 77 177 77 152 96 164 15 163 75 163 75 165 46 173 34 167 93 166 81 167 93 160 16 170 20 170 20	\$122 27	\$61 62 42 06 72 46 87 46 74 94 118 44 193 38 100 18 121 06 89 24 127 68 165 46 193 90 1144 15 107 40 8106 90	\$23 46 62 19 55 74 37 42 84 77 65 12 74 29 857 57
321 94 326 43 326 43 326 73 326 73 330 60 332 49 333 22 333 22 334 60 341 60 341 60 341 57 46 27 46 27 46 27 47 66 378 27 48 2	\$264 21	\$126 12 165 16 185 47 217 33 249 99 249 99 261 33 261 33 261 33 264 37 264 37 268 33 275 45 275 45 271 84 310 84 326 62 371 08 380 04 392 57	\$173 51 247 59 267 39 267 39 291 10 312 54 316 99 348 55 \$279 67
רט דט דט דט דט בע דט בע דט בע דט דט דט דט דט דט בע בע בע בע	4.6	4.10 4.4.5.10 10 10 10 10 10 10 10 10 10 10 10 4.10 ©	10 10 10 10 10 10 TO 70 4
9 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	24.8	4-7-10-08-88-88-88-88-88-88-88-88-88-88-88-88	80 890 890 200 20 111 111
682 628 628 644 683 666 668 668 725 725 726 675 726 726 726 727 726	Average	798 812 797 817 817 816 778 828 828 828 805 805 784 776 776 776 776	939 940 940 935 938 936 936 936
L-4 (Cont.)		T-2	I-7

¹ Water cost and cost of barvesting not included.
² Picking and hauling charges have been deducted.

TABLE B-1

AVERAGE YIELDS AND RETURNS PER ACRE FOR LEMONS, VENTURA COUNTY, AS SHOWN BY RECORDS OF MATURE GROVES CONSIDERED REPRESENTATIVE OF THE VARIOUS AREAS BY THE FARM ADVISOR AND PACKING-HOUSE MANAGERS.

Area	Serial number	Length of records, years	Acreage	Yield, packed- box equivalent ¹	Percentage to by-products plant	Average returns to grower
L-6	1	6	47	309		\$1,151 90
17-0	9	4	27.8	269		1,051 95
	2 3	6	7.9	165		576 31
	4	6	5	193		725 73
	5	6 5 6	6.8	290	****	686 83
	6	6	14.3	91		253 5
	7	6	35.5	195		690 66
	8	6	4.9	274		916 36
	9	6	5.8	161		637 48
	10	6	1.7	246		915 27
	11	6	7.2	85		243 42
	12	6	9	186		665 92
	13	6	9.8	339		1,349 07
	14	6	12.2	216		850 03
	15	6	12.2 6.5	222		861 49
	16	6	3.6	68		203 03
	17	6	5.4	174		654 73
	18	6	2.1	214		668 90
	19		2.1	332		664 79
	20	7	23.7	201		748 S4
	21	6	16.9	326		1,138 46
	22	7	14.8	190		545 09
	23	7	13.0	294		1,163 35
	24	7	67.1	181		591 99
	25	7	8.9	328		1,054 56
	26	7 7	12.0	188		579 40
	27	7	22.9	193		630 43
	28	7	9.0	364		1,220 33
	, Average	6	14	226	12.38	\$793 68
L-7	1	7	37.9	131		\$368 57
	2	7	37.2	204		567 96
	3	7	22.9	306		953 S3
	4	7	4.8	247		733 01
	5	7	4.2	151		445 64
	6	7	5.1	270		763 47
	7		20.5	275		769 39
	8	7	6.0	305		831 68
	9	7	10.1	203		533 08
	10	7	14 3	216		617 93
	11	ī.	35.2	292		S08 S9
	12	7	13.9	112		323 24
	Average	7	17.5	223	12.74	\$632 59

Includes fruit sold loose and fruit sent to by-products plant, all on a packed-box basis.
 Picking and hauling costs, averaging about 45 cents per packed box, not deducted.

TABLE C. GRAPEFRUIT

AVERAGES OF INDIVIDUAL COSTS OF PRODUCTION AND YIELDS PER ACRE

Note.—All records fall within the period 1927-1931 and are from the California Citrus League

			Length				Average costs	sts			S	Viold
	number	Aeres	of record,	Total1	Material	Labor	General	Taxes	Insurance	Deprc- ciation	of	packed
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Water cost and cost of harvesting not included.

TABLE D. WALNUTS

NOTE.—All records fall within the period 1927-1931, and are from the enterprise efficiency studies of the Agricultural Extension Service, University of California AVERAGES OF INDIVIDUAL COSTS OF PRODUCTION, YIELDS, AND RETURNS TO GROWERS PER ACRE

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AVERAGE INDIVIDUAL COSTS OF PRODUCTION, YIELDS, AND RETURNS TO GROWERS PER ACRE TABLE D. WALNUTS-Continued

		-					¥	Average costs				Cost	Vield	Gross
County	Area	number	acreage	of record,	Total ¹	Material	Labor	General	Taxes	Insurance	Depre- ciation	of water	spunod	to
ntura	W-+	73 78 83	13.5 27.5 137	€ 4.67	\$46 30 63 38 73 68	\$1 42 2 08 92	\$21 40 29 95 24 71	\$3 03 5 60 5 03	\$18 47 16 84 21 98	\$21 93	\$1 98 7 70 20 11	\$12 08 11 26 9 66	898 1,127 992	\$171 42 220 72 166 00
		Average	59.5	3.0	\$61.12	\$1.47	\$25 35	\$4 89	\$19 10	\$0 38	\$9 93	\$11 00	1,006	\$186 05

1 Water cost not included.
2 Average for 34 records only.
3 None of the Ventura County two-year records are for 1931 and only two extend into 1930. Since 1930 and 1931 were low-yield years, these two-year records are for 1931 and only two extend into 1930. vield and return.

TABLE E.

AVERAGE ANNUAL COSTS PER ACRE OF BRINGING AN ORANGE GROVE INTO BEARING

	Cumu- lative net	\$92 00 168 52 261 13 261 13 297 80 525 67 630 21 738 66 753 97
Costs per acre	Net	\$92 76 50 76 50 92 65 136 67 127 87 104 54 11 64 11 64
	Total	\$127 00 106 52 130 11 171 67 197 87 218 29 238 81 254 64 269 06
	Net cost of trees	\$5 52 15 67 15 67 23 87 31 54 31 64 41 64
Fauire	ment and land:	883 00 38 00 30 30 30 30 30 30 30 30 30 30 30 30 3
Subtotal	cost and deprecia- tion	\$94 00 68 00 87 00 117 00 117 00 147 75 162 00 174 00 185 75
Deprecia-	equipment and improve- ments²	\$\$ \$4 + 000 118 00 118 00 118 00 118 00 118 00
	Total cash costs	\$90 00 64 00 84 00 89 00 117 00 1129 75 1149 00 156 00 167 75
acre per year	Cash over- head	\$15 00 13 00 14 50 16 00 20 00 23 00 37 00 37 00
	Material	\$50 00 30 00 40 00 50 00 60 00 65 00 72 00 72 00
Cash costs per	Harvest, at 15 cents per box	\$1 50 3 00 6 00 6 75 15 00 18 00 21 75
	Cultural	\$25 00 27 00 27 00 33 00 33 00 35 00 35 00
	Income per acre	\$35 00 30 00 37 50 37 50 70 00 113 75 175 00 210 00 253 75
Viold	paeked boxes per acre	0 0 10 2 20 4 40 40 100 1120 1140
	Age at beginning of year	0-0100465070

¹ Includes returns from intercrops during the first three years. Returns on oranges figured at \$1.75 per packed box to grower at packing house door.

² Heating costs, which start with the third year, are figured at the following amounts per acre per annum: labor, \$6; material, \$6; depreciation on heating equipment, \$14; interest on heating equipment, \$6.

3 Bare land figured at \$500 an acre. Nore: Annual allowance for depreciation of orange trees, approximating \$20 per acre, is computed from the above table as follows:

754 (cumulative net cost) ==\$20.28

45 (estimated life of orchard) - 8 (age depreciation to begin)

TABLE F.

INDEX NUMBERS AND PRICES PAID PER UNIT FOR LABOR AND MATERIAL BY CITRUS GROWERS DURING THE PERIOD 1927 TO 1932

	Tractor,			\$2.50 to \$3.00 per hour for small tractors	\$2 75	\$2.28
Representative prices paid by citrus growers for	Team, per day			Range from \$0.90 to \$1.00	\$0.95	\$0.80
	Labor	Per hour	Un- skilled	Range from 40 to 50 cents	\$0.45	\$0 25
			Skilled	Rango from 50 to 60 cents	\$0.55	\$0.35
	Material	Fuel oil per gallon			\$0 035	\$0 03
		Hydro- cyanic acid, t per per		\$0 50 50 50 50 50 50 50	\$0 20	\$0.46
		Fertilizer ³	Nitrate of soda, per ton	\$50 00 47 00 42 00 42 00 42 00	\$46.20	\$33 00
			Sulphate of ammonia, per ton	\$55 00 56 00 56 00 43 00 34 00	\$48 80	\$24 00
			Organie, per cu. ft.	\$0 09 09 08 08 065	\$0 83	\$0.045
Index numbers	California ²	Walnuts		100 148 185 155 135	157	4 5 1 1 1 1 1 1
		Lemons		100 122 145 146 156 124	137	113
		Valen- cias		100 180 251 122 351 105	182	85
		Navels		100 233 291 183 183 153	231	128
	United States	Taxes		100 258 263 267 267 266	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
		Farm		100 170 169 170 170 152 116	155	98
		Prices received by farmers		100 85 80 80 80 63	18	
		Prices paid for commodi- ties bought		100 154 156 155 146 126	147	1
Period 1909-14 1928 1928 1930					1927-31	1932

¹ The Agricultural Situation, February 1, 1933. Published by the Bureau of Agricultural Economies, United States Department of Agriculture.

² Computed for navels. Valencias and lemons from Table 16 of this report; for walnuts from data furnished by Mr. A. W. Christie of the California Walnut Growers Association.

³ From Fruit Growers Supply Company.

* From fumigating companies.

PUBLICATIONS DIVISION OF WATER RESOURCES



PUBLICATIONS OF THE

DIVISION OF WATER RESOURCES

DEPARTMENT OF PUBLIC WORKS

STATE OF CALIFORNIA

When the Department of Public Works was created in July, 1921, the State Water Commission was succeeded by the Division of Water Rights, and the Department of Engineering was succeeded by the Division of Engineering and Irrigation in all duties except those pertaining to State Architect. Both the Division of Water Rights and the Division of Engineering and Irrigation functioned until August, 1929, when they were consolidated to form the Division of Water Resources.

STATE WATER COMMISSION

First Report, State Water Commission, March 24 to November 1, 1912. Second Report, State Water Commission, November 1, 1912 to April 1, 1914.

•Blennial Report, State Water Commission, March 1, 1915, to December 1, 1916.

Biennial Report, State Water Commission, December 1, 1916, to September 1, 1918.

Biennial Report, State Water Commission, September 1, 1918, to September 1, 1920.

DIVISION OF WATER RIGHTS

- Bulletin No. 1—Hydrographic Investigation of San Joaquin River. 1920-1923.
- *Bulletin No. 2-Kings River Investigation, Water Master's Reports, 1918-1923.
- Bulletin No. 3—Proceedings First Sacramento-San Joaquin River Problems Conference, 1924.
- Bulletin No. 4—Proceedings Second Sacramento-San Joaquin River Problems Conference, and Water Supervisor's Report, 1924.
- Bulletin No. 5—San Gabriel Investigation—Basic Data, 1923-1926.
- Bulletin No. 6—San Gabriel Investigation—Basic Data, 1926-1928.
- Bulletin No. 7—San Gabriel Investigation—Analysis and Conclusions, 1929.
- Biennial Report, Division of Water Rights, 1920-1922.
- *Biennial Report, Division of Water Rights, 1922-1924.
 - Biennial Report, Division of Water Rights, 1924-1926.
- Biennial Report, Division of Water Rights, 1926-1928.

DEPARTMENT OF ENGINEERING

- Bulletin No. 1-Cooperative Irrigation Investigations in California, 1912-1914.
- *Bulletin No. 2-Irrigation Districts in California, 1887-1915.
- Bulletin No. 3—Investigations of Economic Duty of Water for Alfalfa in Sacramento Valley, California, 1915.
- *Bulletin No. 4—Preliminary Report on Conservation and Control of Flood Waters in Coachella Valley, California, 1917.
- *Bulletin No. 5-Report on the Utilization of Mojave River for Irrigation in Victor Valley. California, 1918.
- *Bulletin No. 6—California Irrigation District Laws, 1919 (now obsolete).
- Bulletin No. 7-Use of water from Kings River, California, 1918.
- *Bulletin No. 8-Flood Problems of the Calaveras River, 1919.
- Bulletin No. 9-Water Resources of Kern River and Adjacent Streams and Their Utilization, 1920.
- Biennial Report, Department of Engineering, 1907-1908.
- *Biennial Report, Department of Engineering, 1908-1910.
- Biennial Report, Department of Engineering, 1910-1912.
- Biennial Report, Department of Engineering, 1912-1914.
- *Biennial Report, Department of Engineering, 1914-1916.
- Biennial Report, Department of Engineering, 1916-1918.

Library at Sacramento, California.

*Biennial Report, Department of Engineering, 1918-1920.

*Reports and Bulletins out of print. These may be borrowed by your local library from the California State

DIVISION OF WATER RESOURCES

Including Reports of the Former Division of Engineering and Irrigation

- *Bulletin No. 1-California Irrigation District Laws, 1921 (now obsolete).
- *Bulletin No. 2-Formation of Irrigation Districts, Issuance of Bonds, etc., 1922
- Bulletin No. 3-Water Resources of Tulare County and Their Utilization, 1922.
- Bulletin No. 4-Water Resources of California, 1923.
- Bulletin No. 5-Flow in Callfornia Streams, 1923.
- Bulletin No. 6-Irrigation Requirements of California Lands, 1923.
- *Builetin No. 7-California Irrigation District Laws, 1923 (now obsolete).
- *Bulletin No. 8-Cost of Water to Irrigators in California, 1925.
- Bulletin No. 9-Supplemental Report on Water Resources of California, 1925.
- *Bulletin No. 10—California Irrigation District Laws, 1925 (now obsolete).
- Bulletin No. 11-Ground Water Resources of Southern San Joaquin Valley, 1927.
- Bulletin No. 12—Summary Report on the Water Resources of California and a Coordinated Plan for Their Development, 1927.
- Bulletin No. 13—The Development of the Upper Sacramento River, containing U. S. R. S. Cooperative Report on Iron Canyon Project, 1927.
- Bulletin No. 14-The Control of Floods by Reservoirs, 1928.
- *Bulletin No. 18—California Irrigation District Laws, 1927 (now obsolete).
- *Bulletin No. 18-A—California Irrigation District Laws, 1929 Revision (now obsolete).
- Bulletin No. 18-B-California Irrigation District Laws, 1931 Revision (now obsolete).
- Bulletin No. 18-C-California Irrigation District Laws, 1933 Revision.
- Bulletin No. 19—Santa Ana Investigation, Flood Control and Conservation (with packet of maps), 1928.
- Bulletin No. 20—Kennett Reservoir Development, an Analysis of Methods and Extent of Financing by Electric Power Revenue, 1929.
- Bulletin No. 21-Irrigation Districts in California, 1929.
- Bulletin No. 21-A-Report on Irrigation Districts in California for the Year 1929.
- Bulletin No. 21-B-Report on Irrigation Districts in California for the Year 1930.
- Bulletin No. 21-C—Report on Irrigation Districts in California for the Year 1931. (Mimeographed.)
- Bulletin No. 21-D—Report on Irrigation Districts in California for the Year 1932. (Mimeographed.)
- Bulletin No. 22-Report on Salt Water Barrier (two volumes), 1929.
- Bulletin No. 23—Report of Sacramento-San Joaquin Water Supervisor, 1924-1928.
- Bulletin No. 24-A Proposed Major Development on American River, 1929.
- Bulletin No. 25-Report to Legislature of 1931 on State Water Plan, 1930.
- Bulletin No. 26-Sacramento River Basin, 1931.
- Bulletin No. 27—Variation and Control of Sallnity in Sacramento-San Joaquin Delta and Upper San Francisco Bay, 1931.
- Bulletin No. 28—Economic Aspects of a Salt Water Barrler Below Confluence of Sacramento and San Joaquin Rivers, 1931.
- Bulletin No. 28-A-Industrial Survey of Upper San Francisco Bay Area, 1930.
- Bulletin No. 31-Santa Ana River Basin, 1930.
- Bulletin No. 32-South Coastal Basin, a Cooperative Symposium, 1930.
- Bulletin No. 33—Rainfall Penetration and Consumptive Use of Water in Santa Ana River Valley and Coastal Plain, 1930.
- Bulletin No. 34—Permissible Annual Charges for Irrigation Water in Upper San Joaquin Valley, 1930.
- Bulletin No. 35—Permissible Economic Rate of Irrigation Development in California. 1930.
- Bulletin No. 36-Cost of Irrigation Water in California, 1930.
- Bulletin No. 37—Financial and General Data Pertaining to Irrigation, Reclamation and Other Public Districts in California, 1930.
- Bulletin No. 38-Report of Kings River Water Master for the period 1918-1930.
- Bulletin No. 39—South Coastal Basin Investigation, Records of Ground Water Levels at Wells, 1932.
- Bulletin No. 40—South Coastal Basin Investigation, Quality of Irrigation Waters, 1933.
- Bulletin No. 41-Pit River Investigation, 1933.
- Bulletin No. 42-Santa Clara Investigation, 1933.

^{*} Reports and Builetins out of print. These may be borrowed by your local ilbrary from the California State Library at Sacramento, California.

Bulletin No. 43—Value and Cost of Water for Irrigation in Coastal Plain of Southern California, 1933.

Bulletin No. 44—Water Losses Under Natural Conditions from Wet Areas in Southern California, 1933.

Biennial Report, Division of Engineering and Irrigation, 1920-1922.

Biennial Report, Division of Engineering and Irrigation, 1922-1924.

Biennial Report, Division of Engineering and Irrigation, 1924-1926.

Biennial Report, Division of Engineering and Irrigation, 1926-1928.

PAMPHLETS

Act Governing Supervision of Dams in California, with Revised Rules and Regulations, 1933.

Water Commission Act with Amendments Thereto, 1933.

Rules, Regulations and Information Pertaining to Appropriation of Water in California, 1933.

Rules and Regulations Governing the Determination of Rights to Use of Water in Accordance with the Water Commission Act. 1925.

Tables of Discharge for Parshall Measuring Flumes, 1928.

General Plans, Specifications and Bills of Material for Slx and Nine Inch Parshall Measuring Flumes, 1930.

COOPERATIVE AND MISCELLANEOUS REPORTS

- *Report of the Conservation Commission of California, 1912.
- *Irrigation Resources of California and Their Utilization (Bul. 254, Office of Exp U. S. D. A.) 1913.
- *Report, State Water Problems Conference, November 25, 1916.
- *Report on Pit River Basin, April, 1915.
- *Report on Lower Pit River Project, July, 1915.
- *Report on Iron Canyon Project, 1914.
- *Report on Iron Canyon Project, California, May, 1920.
- *Sacramento Flood Control Project (Revised Plans), 1925.

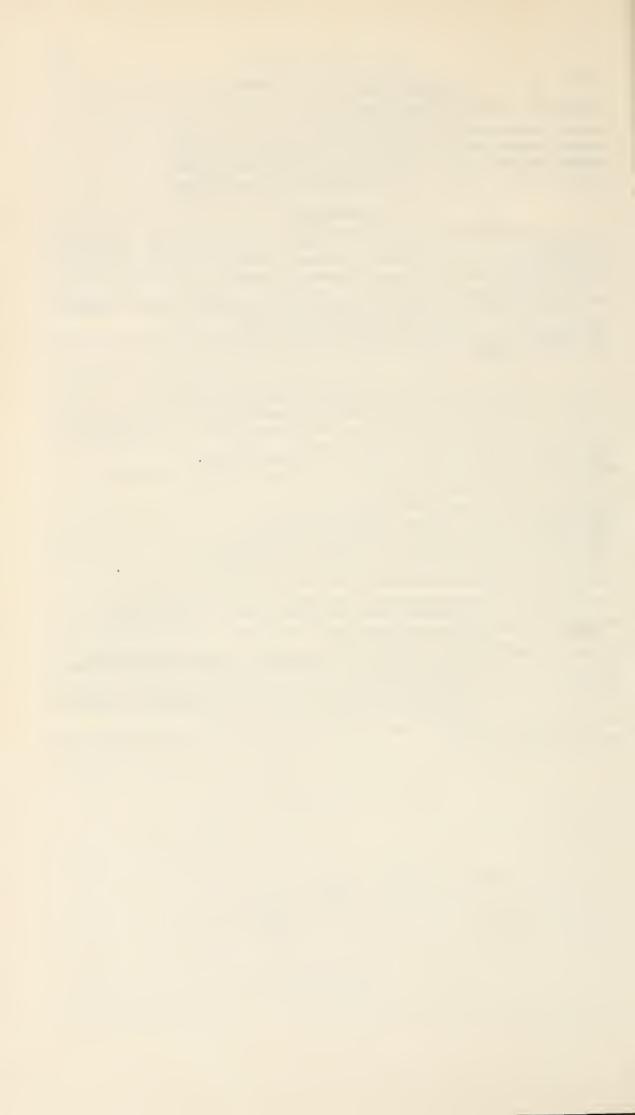
Report of Commission Appointed to Investigate Causes Leading to the Failure of St. Francis Dam, 1928.

Report of the California Joint Federal-State Water Resources Commission. 1930.

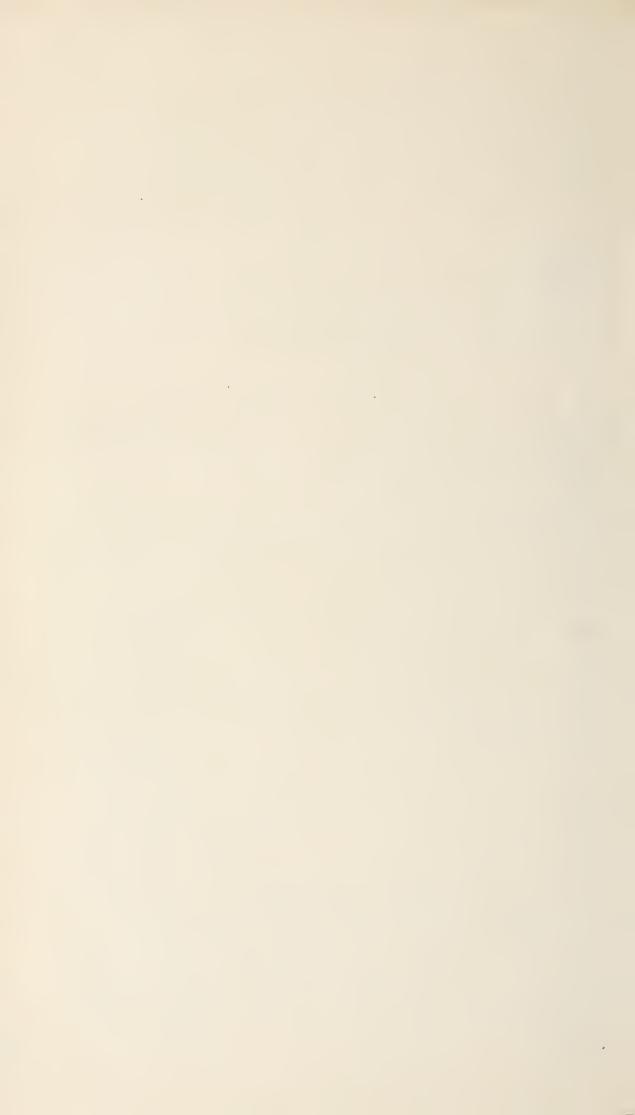
Conclusions and Recommendations of the Report of the California Irrigation and Reclamation Financing and Refinancing Commission, 1930.

- *Report of California Water Resources Commission to the Governor of California on State Water Plan, 1932.
- *Booklet of Information on California and the State Water Plan Prepared for United States House of Representatives' Subcommittee on Appropriations, 1931.
- *Bulletin on Great Central Valley Project of State Water Plan of California Prepared for United States Senate Committee on Irrigation and Reclamation, 1932.

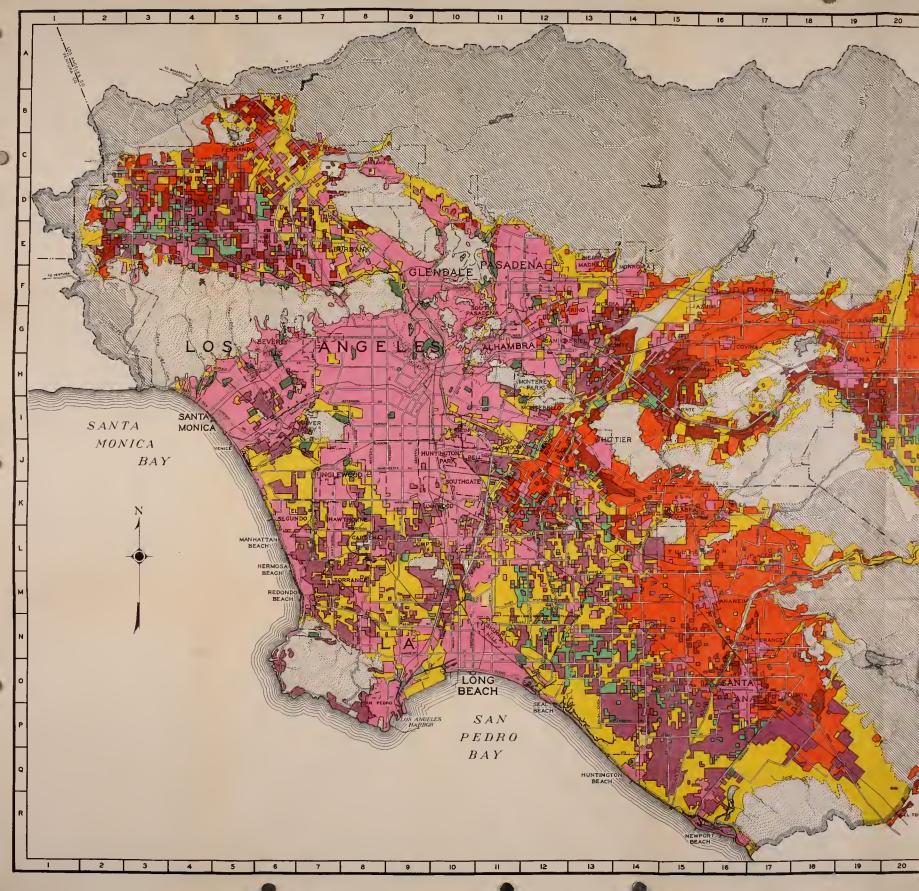
[•] Reports and Bulletins out of print. These may be borrowed by your local library from the California State Library at Sacramento, California.

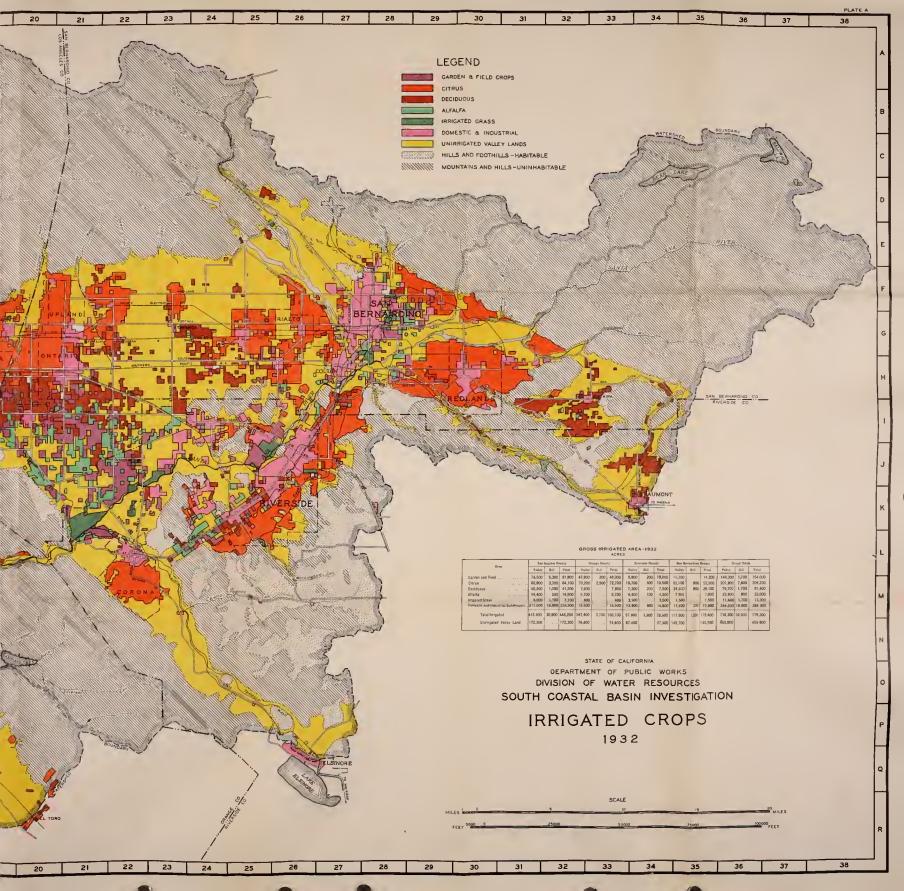


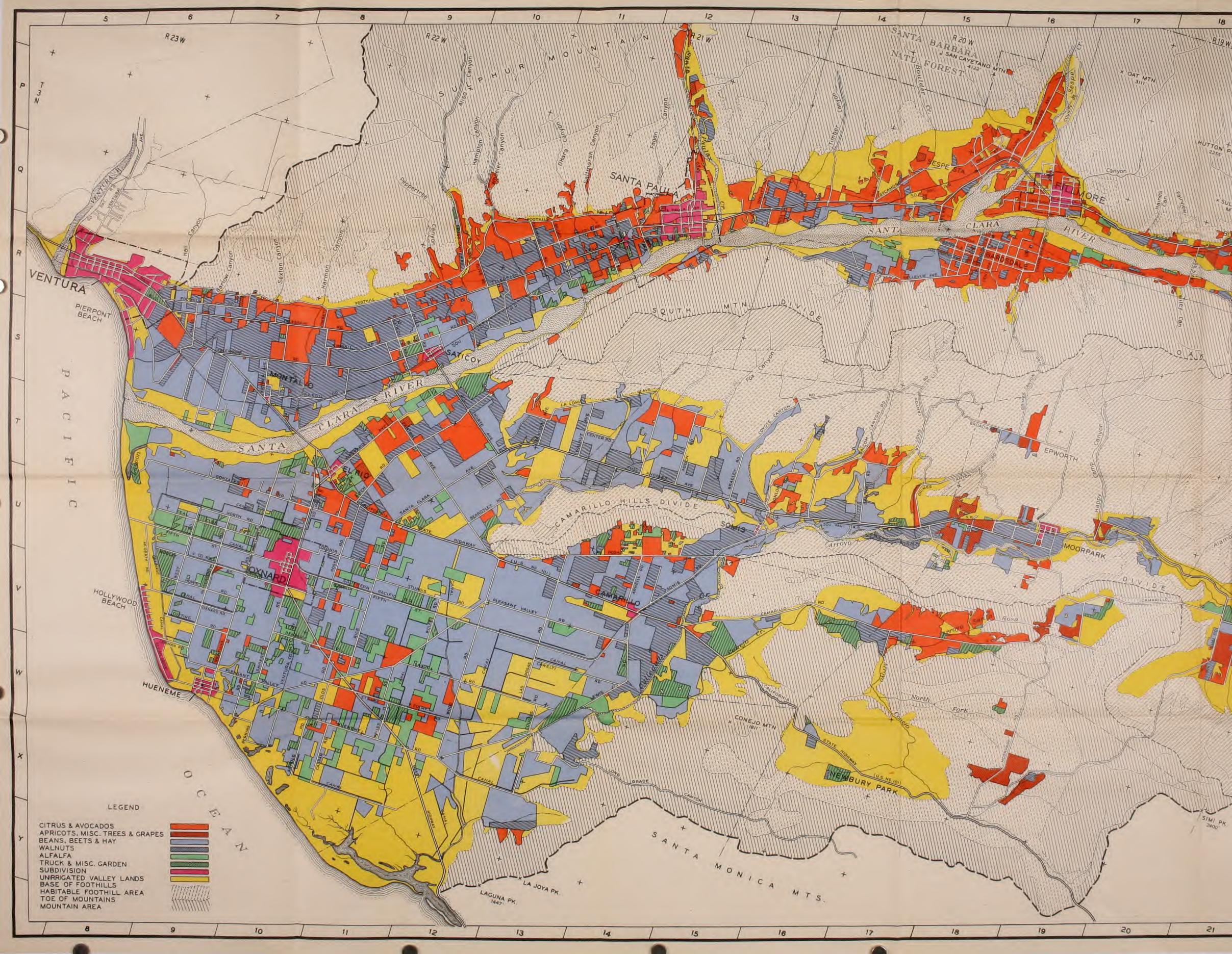


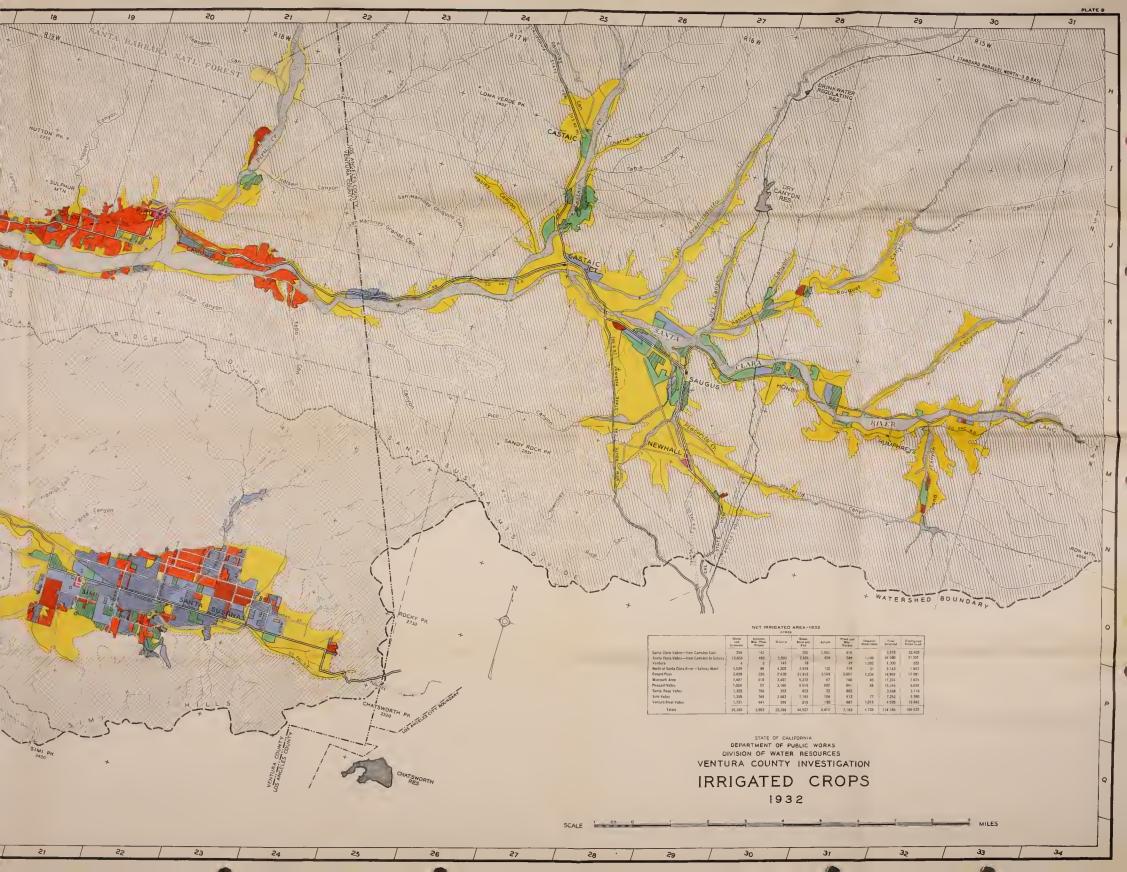












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